PUBLICATION OFFICES:

168-177 POTTER BUILDING, NEW YORK.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

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Matter for the **Editorial** Department should be addressed to

The Editor of The Electrical World, New York.

Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to

W. J. JOHNSTON, Publisher,
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"THE ELECTRICIAN" IN THE UNITED STATES AND "THE ELECTRICAL WORLD" IN THE UNITED KINGDOM.

Arrangements have been made by which the London "Electrician" can be obtained from THE ELECTRICAL WORLD *office,* 168-177 *Potter Building, New York*

The rate of subscription (payable in advance), including postage, is $6 *per annum to any address in the United States, Canada, Mexico or other foreign country.*

Single copies, price 10 *cents, can also be obtained at* THE ELECTRICAL WORLD *office Similarly* THE ELECTRICAL WORLD *can be obtained in England at the office of* The Electrician, 1 *Salisbury Court, Fleet Street, London, E. C.*

The rate for English or foreign subscribers (payable in advance) £1. 1s.

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VOL. XII. NEW YORK, OCT. 6, 1888. No. 14

The Brown Experiments. TWO weeks ago, it will be remembered, we published an able reply from Mr. Harold P. Brown as to some criticisms that had been made upon his experiments with direct and alternating currents, and their effect on the animal organism. This week, Dr. Vander Weyde returns to the subject, and has something to say further as to the principles of construction involved in voltmeters and ammeters. This is a little bit off the main line of controversy, but at the same time is so interesting that we cannot err in giving it a place.

The Specific Resistance of Copper. IN the paper read by Mr. Glover, before the British Association, attention was called to an important point in connection with the tables of resistance in general use. These tables are almost exclusively based on the results of experiments made by Dr. Mathiessen on what he supposed was absolutely pure copper; but, as Mr. Glover points out, the manufacture of copper has been so much improved since the date of those experiments, that not infrequently the results of tests bring out results which appear paradoxical, the conductivity of copper wire sometimes exceeding 100 per cent. Mr. Glover, consequently, advocates a thorough revision of the experiments of Dr. Mathiessen with the materials which are now at our command; and we hope that these suggestions will be taken up by the British Association. We may add that the results obtained by Mr. Glover do not present an isolated case, as it was shown some time ago that the relative conductivity of copper more nearly approached that of silver than is indicated by the tables usually given, based on the authority above mentioned.

Use of the Phonograph. WHATEVER may have been the criticisms against the old phonograph, the conviction must force itself upon those who have studied the subject, that with the rapid improvements that are going on in the phonograph and graphophone, their use will become general in a short time. The experience of those who use the instruments for the first time is no guide in any way as to their values, because, as in the case of the telephone, it requires a little practice to become accustomed to interpret the sounds which emanate from the cylinder. Once acquired, however, the reading from the phonograph is as simple a matter as the reception of a message over the telephone; and, indeed, in some cases far easier. Our illustrations on another page, of the improved form of the instruments, show both machines driven by electric motors, and, as there noted, the battery power required to operate the phonograph has been reduced to such an extent that nothing stands in the way of the adoption of electricity as the motive power for driving the machine, even when current is not available from a central station.

Aluminium. WHILE the production of aluminium in the electric furnace is recognized as a valuable step in advance for the production of that material in the shape of its alloys, the criticism has been made that the addition of the pure aluminium to the alloys is quite as efficacious as the production of the same in the electric furnace, and hence that the latter has not so decided an advantage as would appear at first sight. Recent investigations, however, have shown conclusively that a distinct advantage is gained with the employment of alloys formed in the electric furnace, for it has been proved that when pure aluminium is added for the purpose of increasing the strength of metals in the molten state, the metal does not thoroughly mix, and that by remelting the aluminium, especially in the case of iron, is reduced in percentage by volatilization. In other words, it requires the intense heat of the electric furnace to form stable aluminium alloys, and experiments have shown that the alloys so formed undergo no change of composition after repeated remeltings. This is a valuable property, and one which will go far towards firmly establishing the electric furnace as the best method of obtaining aluminium and its alloys.

Lost Inventions. A PARAGRAPH is now going the rounds of the daily press to the effect that "many of Edison's most valuable inventions have been lost to the world by the avarice of that grasping monopoly, the Western Union Telegraph Company." The article states with great circumstantiality how this telegraphic leviathan has buried out of sight inventions which, if utilized, would greatly decrease the cost and increase the speed of operation, but which are, nevertheless, considered to be more profitable to suppress than to use. While some arrangement probably exists between the Western Union and Mr. Edison, so far as his telegraphic inventions are concerned, we doubt very much whether that company would allow any invention to remain dormant, the utilization of which would, in the least, increase the efficiency of its working and, most of all, decrease the cost of the service. Naturally an inventor of Mr. Edison's calibre would be able to produce many things which are new, but the introduction of which, for various reasons, might entail changes in apparatus requiring special training of operators, and attendant inconveniences which would make their adoption a matter of very serious consideration. Hence, while many of these inventions may be valuable, and would, under other circumstances, come into use, the general assertion that progress is impeded by this procedure is rather broad, and, we think, not in conformity with the intelligence which has characterized the management of the Western Union Company in the past.

Electric Motors in Europe. THOUGH it is well known that the transmission of power by electricity in England has made little progress, as compared with the enormous extent to which it has been developed in this country, we are hardly prepared to learn from so good an authority as Prof. Ayrton, that in the whole of Great Britain there are hardly one hundred electric motors at work at the present time, as compared with six thousand at work in this country. It would be difficult to prove, we think, that the much abused English Electric Lighting Act is entirely responsible for this state of backwardness, and we are confirmed in this opinion by the very neat definition which Prof. Ayrton has given of the difference of the term "inertia," as looked at from the English and American standpoints. As Prof. Ayrton puts it, inertia from the foreign standpoint is a "resistance to motion," whereas, looked at from the American standpoint, it means "resistance to standing still." Thus, while our English cousins boast that they are ahead of us so far as science is concerned, and even assert that their machines are better than ours, the fact remains that while they are waiting for developments and improvements, we go ahead and attain our ends by actual experience; and thus, so far as actual results are concerned, ascertain the best practice, not by speculation, but by work. And in such results, indeed, is embodied the final test of everything. However well theory may indicate results, it is only by actual experience that the true value of any system or device can be ascertained, and though trial and failure may be in the first place a more expensive way of obtaining this true value, it certainly has the advantage of getting at results quickly, and in a shape which mere speculation could never reach.

The Manufacture of Light. A DECIDED change may be perceived in the speculations which have, within recent times, been made on the possibilities and methods of producing artificial illumination. From the old tallow dip to the incandescent and arc lamp is recognized as a great advance. But we are now more than ever forcibly reminded of the fact by prominent writers, that, scientifically considered, even our most improved methods of lighting are barbarous in their wastefulness of energy. The light of the little glowworm is pointed out as an example of the small amount of energy actually required to afford a given amount of illumination, when that energy is in proper form to act upon the retina of the eye. Why, we are asked, should we effect tens of millions of vibrations per second to produce a luminous effect, by working up through the lower scales of vibratory energy, as presented in the production of heat? The question evidently resolves itself into devising means for producing billions of vibrations per second, such that matter may be put into a state of luminosity without the intervention of other forms of vibratory energy. It may have occurred to many that such a high rate of vibration, or change of state, might be obtained by electrical means of a comparatively simple kind, such as by the impulses produced in the coils of a rapidly revolving armature. But a moment's thought will show that probably little can be expected from that source with any machine running at a practicable speed. The recent investigations would seem to show that the oscillation produced in electrostatic discharges approaches more nearly to this rate of vibration required to effect luminosity, and in this direction we may hope to obtain some success, though, as pointed out by Professor Lodge, we have everything to learn with regard to this subject. We know tolerably well the conditions to be fulfilled in the solution of this problem, but the means for carrying them out are still to be devised.

The Electric Transmission of Power. AMONG the great popular attractions at the meetings of the British Association are the lectures which are delivered in the evening each year by some scientific celebrity. At Manchester in 1887 it will be remembered, Professor George Forbes delivered one of his brilliant and characteristic addresses on electric lighting. This year at Bath the address was delivered by Professor Ayrton, who chose as his subject the electric transmission of power. The lecture was a comprehensive one, and must have been very entertaining and instructive to the large audience. It showed how in ringing a bell or sending a telegraph message there is an electrical transmission of power, and then went on to describe what had been done in the distribution of current to lamps and to motors, and for electric welding. Professor Ayrton stated that in America there were 6,000 motors driving machinery, while in Great Britain there were hardly 100; and he might have doubled the figures for America. In respect to electric railways he pointed to the work that had been done in this country, and he said that every English electrician who traveled in this country came back impressed "with the enterprise and the happy-go-lucky success" of their brethren here. As to high potential, whether for lighting or for power transmission, as exemplified by American practice, he was compelled to conclude that it was now what 30 miles an hour was half a century ago—uncanny, rather than dangerous. We are glad to see that Prof. Ayrton had a good word to say for telpherage, which he was right in speaking of as a perfectly trustworthy and most economical method of utilizing distant steam or water power to transport goods automatically, and which might also be used for passenger traffic, giving us the luxury of ballooning without its perils. In dealing with more than one branch of this subject, Professor Ayrton rallied his hearers somewhat playfully on the backwardness of England in the various electrical developments; and, even admitting that our practice here is sometimes a little bit reckless and hap-hazard, he appeared ready to grant that it was better to have such practice than be content to theorize, sitting still and doing nothing. One is pleasantly accustomed to think of England in the vanguard of progress, and there seems no good reason why she should not be there to-day, as she has been in the past.

NEW BOOKS.

Die Erzewgung und Verteilung der Elektrizitaet in Zentral Stationen. By Dr. Martin Krieg. Magdeburg: 1888. A. & R. Faber. 371 pp. 5½ × 8½ in.

One of the indications of the stability of the electric lighting industry is to be looked for in the appearance of works, which, based on the experience of the past, show what methods are best adapted for obtaining success in the operation of central stations. The present author has taken up this question, and has devoted special attention to the discussion of the best methods of furnishing electricity to consumers over extended areas. The work begins with an excellent analysis of the leading machines adapted for central station work, including both the direct current and the alternating, and the operation of stations in connection with storage batteries is also fully considered. Another chapter is devoted to the various systems of distribution, their advantages and disadvantages, their methods of regulation, and general information on materials for conductors and methods of running and testing.

The author has devoted special attention to the most economical methods of distribution, and has well applied the method of graphical statics to this purpose. To those interested in this particular branch of the art we recommend this work for careful consideration, as the solution of problems by this method seems to be adapted to give very good results, and has, we believe, been successfully applied in this country. Several practical examples are also embodied, showing the application of these methods. The work is written in as popular a style as such a subject can admit of, and with the numerous illustrations contained in it presents a valuable addition to the literature of lighting.

Preparations for Indication. By Robert Grimshaw, M. E. New York: 1888. The Practical Publishing Co. 56 pp. 4 × 6 in. Price, $1.

Electric light managers have long since recognized that one of the principal points of economy in running is to be looked for in the reduction of the coal bill, and thus the proper operation of their steam engines is a subject of paramount importance. Hence, in the best stations the engines are regularly indicated in order to be certain that the valves, and everything connected with the consumption and distribution of steam in the engine, are in proper order. With the object of instructing those unacquainted with the methods employed in erecting the gearing and arranging the details for indicating an engine, the author has entered into a minute description of the various methods to be adopted in such cases, and thus treats very fully on the methods of attaching the gear to the cross-head of the various types of Corliss and high-speed engines, the attachment of the lever to the ceiling or to the floor, the arrangement of the gearing, piping, etc.

The book is thoroughly well written, and so plain that an ordinary mechanic can learn therefrom the full details for this important operation.

The Elements of Electric Lighting. By Philip Atkinson, A. M., Ph. D. New York: 1888. D. Van Nostrand. 260 pp. 5×7½ in. Price, $1.50.

The aim of the author, as set forth in the preface to the present work, has been to present a comprehensive view of the present status of electric lighting in such a form as to make the subject plain to those not specially conversant with the art. In carrying out this idea, the author explains in as simple language as possible, first, the theory of electricity as generally adopted; he then enters into the principles of construction of the chief apparatus for generating electricity, the dynamo, describing its various elements and its action.

In this way the continuous current and alternating current machines are fully described, and this is followed up by chapters on electrical terms, units and instruments for electrical measurements. The arc and incandescent lamps and storage batteries are then treated of, and the book closes with a chapter on the various methods of distribution, together with a description of the accessories employed for safety and regulation. The work is well printed and illustrated by engravings wherever the text admits of them.

Calculating the Internal Resistance of a Storage Battery.

BY J. D. DALLAS.

The following is a good method, if not a new one, of calculating the internal resistance of a secondary battery:

By preference take an odd number of cells n; arrange these so that $\frac{n+1}{2}$ are in opposition to the other $\frac{n-1}{2}$ cells. Then while the internal resistance is that of the whole number of cells, the E. M. F. is that of one. Take, say, 33 cells, an ordinary series for 60-volt lamps; then join up 16 in opposition to the other 17. Connect up these cells as shown in the accompanying diagram and known as Kempe's test, where C is a condenser, K_1 and K_2 two keys, G a galvanometer and S a shunt of a suitable resistance.

Two readings are now taken. The first, D, which is the throw produced on the galvanometer when K_1 is let up after having been depressed. The second, d, obtained by first depressing K_2, then K_1, and then letting the two keys up. Calling R the internal resistance of the whole battery, we have:

$$\frac{S}{R+S} = \frac{d}{D}; \text{ or } R = S \times \frac{D-d}{d}.$$

The best condition for taking the test is when $D = 3\,d$. The galvanometer should, by preference, be ballistic, although any other form of instrument may be used. If the throw D be too great, place the two condensers in series.

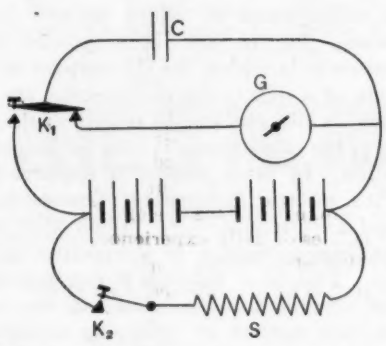
The difficulty always encountered in measuring the internal resistance of a secondary cell is, that the E. M. F. is very high and the internal resistance very small.

Manufacture of Light.*

BY DR. OLIVER LODGE, F. R. S.

The conclusions at which we have arrived, that light is an electrical disturbance, and that light-waves are excited by electric oscillations, must ultimately, and very shortly, have a practical import.

Our present systems of making light artificially are wasteful and ineffective. We want a certain range of oscillation, between 7,000 and 4,000 billion vibrations per second; no other is useful to us, because no other has any effect on our retina; but we do not know how to produce vibrations of this rate. We can produce a definite vibration of one or two hundred or thousand per second; in other words, we can excite a pure tone of definite pitch, and we can command any desired range of such tones continuously by means of bellows and a key-board. We can also (though the fact is less well-known) excite momentarily definite ethereal vibrations of some millions per second, as I have at length explained; but we do not at present seem to know how to maintain this rate quite continuously. To get much faster rates of vibration than this we have to fall back upon atoms. We know how to make atoms vibrate; it is done by what we call "heating" the substance, and if we could deal with individual atoms unhampered by others, it is possible that we might get a pure and simple mode of vibration from them. It is possible, but unlikely; for atoms, even when isolated, have a multitude of modes of vibration special



Determining the Internal Resistance of Storage Batteries.

to themselves, of which only a few are of practical use to us, and we do not know how to excite some without also the others. However, we do not at present even deal with individual atoms; we treat them crowded together in a compact mass, so that their modes of vibration are really infinite.

We take a lump of matter, say a carbon filament or a piece of quicklime, and by raising its temperature we impress upon its atoms higher and higher modes of vibration, not transmuting the lower into the higher, but superposing the higher upon the lower, until at length we get such rates of vibration as our retina is constructed for, and we are satisfied. But how wasteful and indirect and empirical is the process. We want a small range of rapid vibrations, and we know no better than to make the whole series leading up to them. It is as though, in order to sound some little shrill octave of pipes in an organ, we were obliged to depress every key and every pedal, and to blow a young hurricane.

I have purposely selected as examples the more perfect methods of obtaining artificial light, wherein the waste radiation is only useless, and not noxious. But the old-fashioned plan was cruder even than this; it consisted simply in setting something burning, whereby not only the fuel but the air was consumed, whereby also a most powerful radiation was produced in the waste waves of which we were content to sit stewing, for the sake of the minute, almost infinitesimal, fraction of it which enabled us to see.

Every one knows now, however, that combustion is not a pleasant or healthy mode of obtaining light; but everybody does not realize that neither is incandescence a satisfactory and unwasteful method which is likely to be practiced for more than a few decades, or perhaps a century.

Look at the furnaces and boilers of a great steam engine driving a group of dynamos, and estimate the energy expended; and then look at the incandescent filaments of the lamps excited by them, and estimate how much of their radiated energy is of real service to the eye. It will be as the energy of a pitch pipe to an entire orchestra.

It is not too much to say that a boy turning a handle could, if his energy were properly directed, produce quite as much real light as is produced by all this mass of mechanism and consumption of material.

There might, perhaps, be something contrary to the laws of nature in thus hoping to get and utilize some specific kind of radiation without the rest; but Lord Rayleigh has shown in a short communication to the British Association at York† that it is not so, and that, therefore, we have a right to try to do it. We do not yet know how, it is true, but it is one of the things we have got to learn.

Any one looking at a common glow worm must be struck with the fact that not by ordinary combustion, nor yet on the steam engine and dynamo principle, is that easy light produced. Very little waste radiation is there from phosphorescent things in general. Light of the kind able to affect the retina is directly emitted, and for this, for even a large supply of this, a modicum of energy suffices.

Solar radiation consists of waves of all sizes, it is true; but then solar radiation has innumerable things to do besides making things visible. The whole of its energy is useful. In artificial lighting nothing but light is desired; when heat is wanted it is best obtained separately, by combustion. And so soon as we clearly recognize that light is an electrical vibration, so soon shall we begin to beat about for some mode of exciting and maintaining an electrical vibration of any required degree of rapidity. When this has been accomplished, the problem of artificial lighting will have been solved.

* Extract from "Modern Views of Electricity."—*Nature*.

Brave Telegraphers.

The generous and unexpected action of the New York *World* in starting a subscription for the telegraphers at Jacksonville, Fla., has made all of them feel greatly pleased. They have remained nobly at their posts, with no expectation or hope of pecuniary reward, and while of course the money will be very acceptable to them, yet the main gratification comes from the knowledge that somebody has noted their self-sacrifice and given them due credit therefor. They are all young men, several of them with small families. Their action in remaining at work while one after another of their comrades was taken from their side speaks volumes for their brave attention to duty.

W. J. Wallace, the traffic chief, has lost his wife and child, while the wives and children of several others are seriously ill. The following is the roll of honor at the office now: D. F. Dillon, superintendent; R. H. Fleming, acting manager; W. J. Wallace, traffic chief; J. P. Rivers, night chief; Operators W. G. Shearer, J. R. Daniels, T. F. Wallace, C. F. Sweeney, J. C. Robbins, G. G. Hollenbech, W. S. Ford, W. H. Turner, G. H. Armstrong and C. H. Berkner; Clerks, W. D. Webb, P. C. Convers, P. J. Mahoney, H. Smith, Miss A. O'Connor; John Hedlin, chief foreman of repairs; C. W. Wallace, office boy, and five messenger boys—Charles Grenwood, Dan Mahoney, J. S. Campbell, F. D. Medicio and W. L. Davis.

Of these Messrs. Sweeney, Armstrong, Webb are sick and W. S. Ford has died. The latter recovered from the fever a while ago and went to work again before recovering his strength. He had a relapse and was sent to the Sand Hills. Webb was taken down later and Mr. Wallace has not yet recovered from the shock of the great loss of his family. Two messenger boys are now ill and one convalescent. H. L. Robinson, another clerk, died last week. All have done an immense amount of work, from the superintendent down to the messenger boys, some of the night operators averaging sixteen hours daily. The press of the country and the people generally are indebted to these hard-worked young men for the full reports that have gone forth from the stricken city.

Personal Experience of a Shock.

BY T. D. BOTTOME.

Thinking some of the readers of The Electrical World might be interested in a personal experience of a shock by an intermittent current, I will give an account of one that occurred to me. On touching two terminals to close a circuit on some experimental apparatus, I thought of course I had grasped the insulation, but the bare end of a flexible wire managed to touch my right-hand fingers while I held the binding screw in the other hand. I was instantly thrown down and held perfectly rigid, unable to speak, it seemed to me, for two or three minutes, but probably twenty or thirty seconds would be nearer the actual truth. I felt unconsciousness coming on, when suddenly I became loosened and I lay perfectly limp a moment or so. I got up, but was scarcely able to walk, the pains being greatest in the hips. However, I got a voltmeter and found 140 volts on the circuit, and the alternations or intermittences were 150 per second, while I found my resistance, under the same conditions, to be 4,500 ohms. The wire that slipped out of my hand left a burn on my forefinger in the shape of an elliptical hole about $\frac{5}{32}$ inch deep, and scarred the flesh about the hole at a radius of ¼ inch. During the contact I felt difficulty in breathing but five minutes afterward my skin was all aglow, as if a bath brush and Turkish towel had been used vigorously, while the respiration became full and a trifle quickened. Two days afterward I was all right, except a little soreness all over.

† B. A. Report, 1881, p. 526.

The New Phonograph and Graphophone.

Since our recent description of the Edison phonograph and the Tainter graphophone, various changes have been embodied in the construction of both these machines, which make the operation of each more efficient, and have improved the articulating properties considerably. The new Edison phonograph, which is shown in the engraving, Fig. 2, has been remodeled, and the governor, which was formerly placed within the case beside the motor, is now placed on top of the same, and in full view. By means of this governor the speed of the machine can be regulated

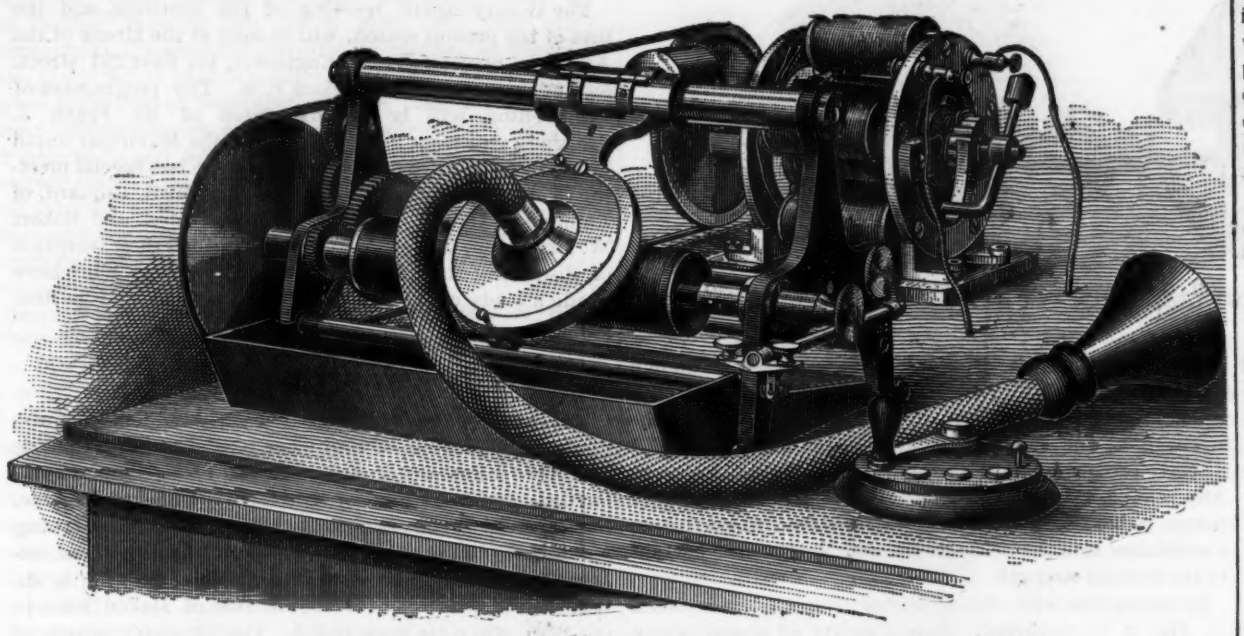


FIG. 1.—TAINTER GRAPHOPHONE DRIVEN BY LUGO MOTOR.

to the best advantage. The spindle of the motor passes through the top of the base, and carries two pulleys, on each of which there runs a belt. The upper pulley drives the governor, while the lower drives the cylinder of the phonograph, the belt running over a pair of guide pulleys on to the main driving pulley, and also around a subsidiary driving pulley to a screw which is brought into action when it is required to repeat.

The two diaphragms supported on a pivot are employed respectively for recording and reproducing. Our engraving shows the recording diaphragm in position against the cylinder. This diaphragm is constructed of malleable glass and carries a stylus, which engraves the record upon the cylinder. The reproducing diaphragm is made of bolting silk thinly coated with shellac, and the stylus is attached to its cylinder by means of a small piece of cork, which forms a yielding support for it. The electric motor, as stated before, is inclosed in the base, and consists of a small 4-pole machine having a Gramme ring. With the old type of motor 6 cells were required to drive the same, but with the new one, a single Grenet cell is amply sufficient to drive it at the required speed, so that the cost of maintenance has been greatly decreased, and the care required for the battery considerably reduced. A change has also been made in the method of reversing the instrument for repeating. In the form of a few months ago, the kick-back screw was thrown into action, and the diaphragm lifted from the cylinder by means of keys which were depressed by the finger. In the new instrument this process is performed by means of a milled head screw shown on the right of the instrument. By turning this screw, a cam is put into operation, which, when thrown a certain distance, lifts the diaphragm from the record, and a further movement puts the kick-back screw into operation so as to move the diaphragm backward over the cylinder. The articulation with the new instrument has been considerably improved by the adoption of a new form of cutting stylus, which gives a far more perfect record than formerly.

The graphophone which is shown in the illustration, Fig. 1, has also undergone some changes which have increased its efficiency, and our illustration shows the machine connected to a Lugo motor, which drives it, and the speed of which can be varied at will by the manipulation of the switch.

Conceptions of the Nature of Electricity.

At the close of an able address at Bath, as President of Section G, Mr. W. H. Preece, after summarizing all the great achievements in the electrical domain, said:

It seems incredible that, having utilized this great power of nature to such a wide and general extent, we should be still in a state of mental fog as to the answer to be given to the simple question—What is electricity? The engineer and the physicist are completely at variance on this point. The engineer regards electricity, like heat, light and sound, as a definite form of energy, something that he can generate and destroy, something that he can play with and utilize, something that he can measure and apply. The physicist—at least some physicists, for it is difficult to find any two physicists that completely agree with each other—regard electricity as a peculiar form of matter permeating all space as well as all substances, together with the luminiferous ether which it permeates like a jelly or a sponge. Conductors, according to this theory, are holes or pipes in this jelly, and electrical generators are pumps that transfer this hypothetical matter from one place to another. Other physicists, following Edlund, regard the ether and electricity as identical, and some, the disciples of Helmholtz, consider it as an integral constituent of nature, each molecule of matter having its own definite charge, which determines its attraction and its repulsion. All attempts to revive the Franklinian, or material, theory of electricity, have, however, to be so loaded with assumptions and so weighted with contradictions, that they completely fail to remove electricity from the region of the mysterious. It is already extremely difficult to conceive the existence of the ether itself as an infinitely thin, highly elastic medium, filling all space employed only as the vehicle of those undulatory motions that give us light and radiant heat. The material theory of electricity requires us to add to this another incomprehensible medium embedded or entangled in this ether, which is not only a medium for motion, but which is itself moved. The practical man, with his eye and his mind trained by the stern realities of daily experience, on a scale vast compared with that of the little world of the laboratory, revolts from such wild hypotheses, such unnecessary and inconceivable conceptions, such a travesty of the beautiful simplicity of nature.

He has a clear conception of electricity as something which has a distinct objective existence, which he can manufacture and sell, and something which the unphilosophic and ordinary member of society can buy and use. The physicist asserts dogmatically: "Electricity may possibly be a form of matter—it is not a form of energy." The engineer says distinctly: "Electricity is a form of energy—it is not a form of matter; it obeys the two great developments of the present generation—the mechanical theory of heat and the doctrine of the conservation of energy." There must be some cause for this strange difference of views. It is clear that the physicist and the engineer do not apply the term electricity to the same thing. The engineer's electricity is a real form of energy; the speculative philosopher's electricity is a vague subjective unreality which is only a mere factor of energy and is not energy itself. This factor, like force, gravity, life, must, at any rate for the present, remain unknowable. It is not known what force is; neither do we know what is matter or gravity. The metaphysician is even doubtful as regards time and space. Our knowledge of these things commences with a definition. The human mind is so unimpressionable, or language is so poor, that writers often cannot agree even on a definition. The definition of energy is capacity for doing work. We practical men are quite content to start from this fiducial line, and to affirm that our electricit is a something which has a capacity for doing work; it is a peculiar form of energy. The physicist may speculate as much as he pleases on the other side of this line. He may take the factors of energy, and mentally play with them to his heart's content; but he must not rob the engineer of his term *electricity*. It is a pity that we cannot settle our difference by changing the term. Physicists might leave the term *electricity* to the form of energy, which is an objective reality, and which the ordinary mortal understands; while engineers would be quite content if speculative physicists and enthusiastic mathematicians would call their subjective unreality, their imaginary electrical matter, by some other term. If it be necessary to mentally create some imaginary matter to fulfill the assumptions and abstractions of their mathematical realizations, let them call it *coulombism* or *electron*, and not appropriate the engineer's generic and comprehensive term electricity. The engineer finds the motions of existing matter and of the ether quite sufficient to meet all his requirements, and to account for all those phenomena which are called electrical.

It seems paradoxical to assert that two unrealities can form a reality, or that two subjective ideas can become an objective one; but it must be remembered that in all electrical phenomena that which makes them real and objective is derived from without. The motion that renders an electrical phenomenon evident is imparted to it from some other form of energy. The doctrine of the conservation of energy asserts that energy is never destroyed, it is only transformed—work must be done to render it evident. No single electrical effect can be adduced which is not the result of work done, and is not the equivalent of energy absorbed. The engineer's notion of work—something done against resistance; and of power—the rate at which this change of condition is effected—are the keystones to the conception of the character of those great sources of power in nature whose direction to the uses and convenience of man is the immediate profession of those who generally assemble together in Section G of the British Association to discuss the "practical applica-

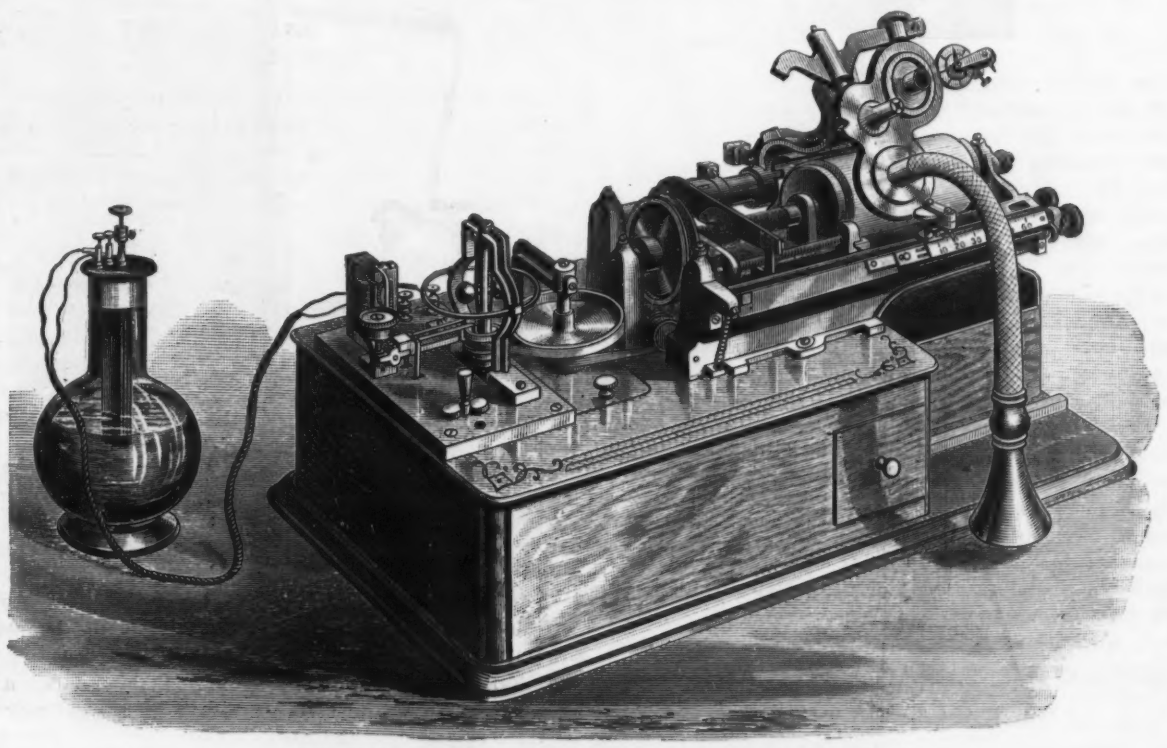


FIG. 2.—THE NEW EDISON PHONOGRAPH.

tion of the most important principles of natural philosophy which has, in a considerable degree, realized the anticipations of Bacon and changed the aspect and state of affairs in the whole world."

A New Electric Postal Railway.

The Sprague Electric Railway and Motor Company is now building for the Electro-Automatic Transit Company, of Baltimore, three 25 h. p. railway motors of a special type for operating a car on the last named company's experimental road. This road has been erected at Laurel, about twenty miles out of Baltimore, and carries three rails, one above the car for carrying current, and two below, which support the car and constitute the return circuit. The motive power for this road will be supplied entirely

electricity, and the cars will be controlled and the brakes applied by the same power. Each car is built of sheet iron, is two feet square and about twenty-one feet long. Two cars constitute a train, and when so joined, they are connected after the vestibule pattern by a flexible connection the size of the car itself. The speed which it is expected to attain is five miles per minute. It is the intention to soon build two roads for carrying mails and other light freight, one to be between Baltimore and Washington and the other between St. Paul and Chicago. The company, we understand, is also under contract with the English Government to construct several postal roads in that country upon the demonstration of successful performances in this country.

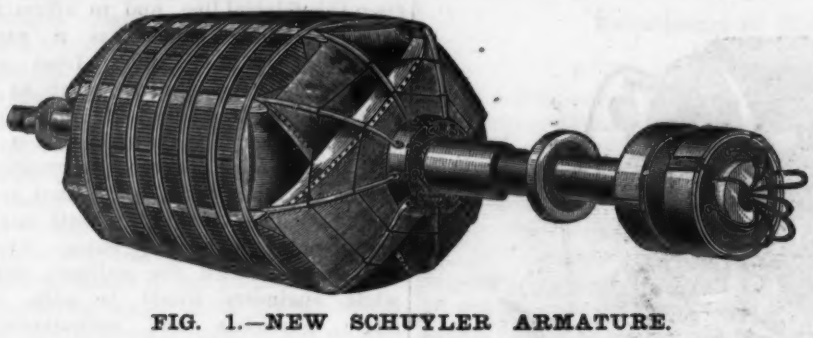


FIG. 1.—NEW SCHUYLER ARMATURE.

New Apparatus of the Schuyler Electric Company.

The system of the Schuyler Electric Company has recently been considerably improved, especially with regard to the methods employed for regulation in the safety of the circuits. Among the improvements to be noted in the machine is the armature, the new form of which is shown in Fig. 1. As will be seen, it is constructed with four coils, which are so arranged as to allow of perfect ventilation.

This armature is of the drum type, the body being a cylinder built up of sheet iron rings securely fastened to the shaft. The ends of this cylinder are open, allowing a free circulation of air through its entire length, thus insuring coolness in this important part of the dynamo when running. The winding is composed of four coils separated from each other by wood strips secured to the drum, each coil being effectually insulated from the other, care being taken to preserve the openings at the ends, to insure ventilation. Each coil is wound in two parts, one-half the full number of layers deep on either side of the shaft and the two inside ends spliced together, maintaining the proper direction. This leaves both ends on the outside and obviates the delay and expense of removing an entire coil in case of a broken inside end.

With the connections and commutator used on this armature the current is constantly flowing through two coils in multiple and one in series, leaving one between the brushes cut out, thus making less strain upon them than if in circuit continually. Another advantage is that in case of a possible accident to any one coil it can be disconnected with its mate at right angles, and the machine still be able to carry part of its load.

The terminals of the coils are secured to an insulated collar, from which the shaft wires are connected to the commutator.

Attention has also been given to the continuous lubrication of the bearings, so that the machine may be operated for a long space of time without attention. The new regulator is constructed as shown in the illustration, Fig. 3. This is connected directly with the field magnets and acts upon the latter, varying the strength of the same, so that the energy consumed is directly proportional to the number of lights in circuit. Any increase in the current, due to the turning off of lamps, immediately acts upon the regulator, which throws a resistance into the field circuit and reduces the current to the normal strength.

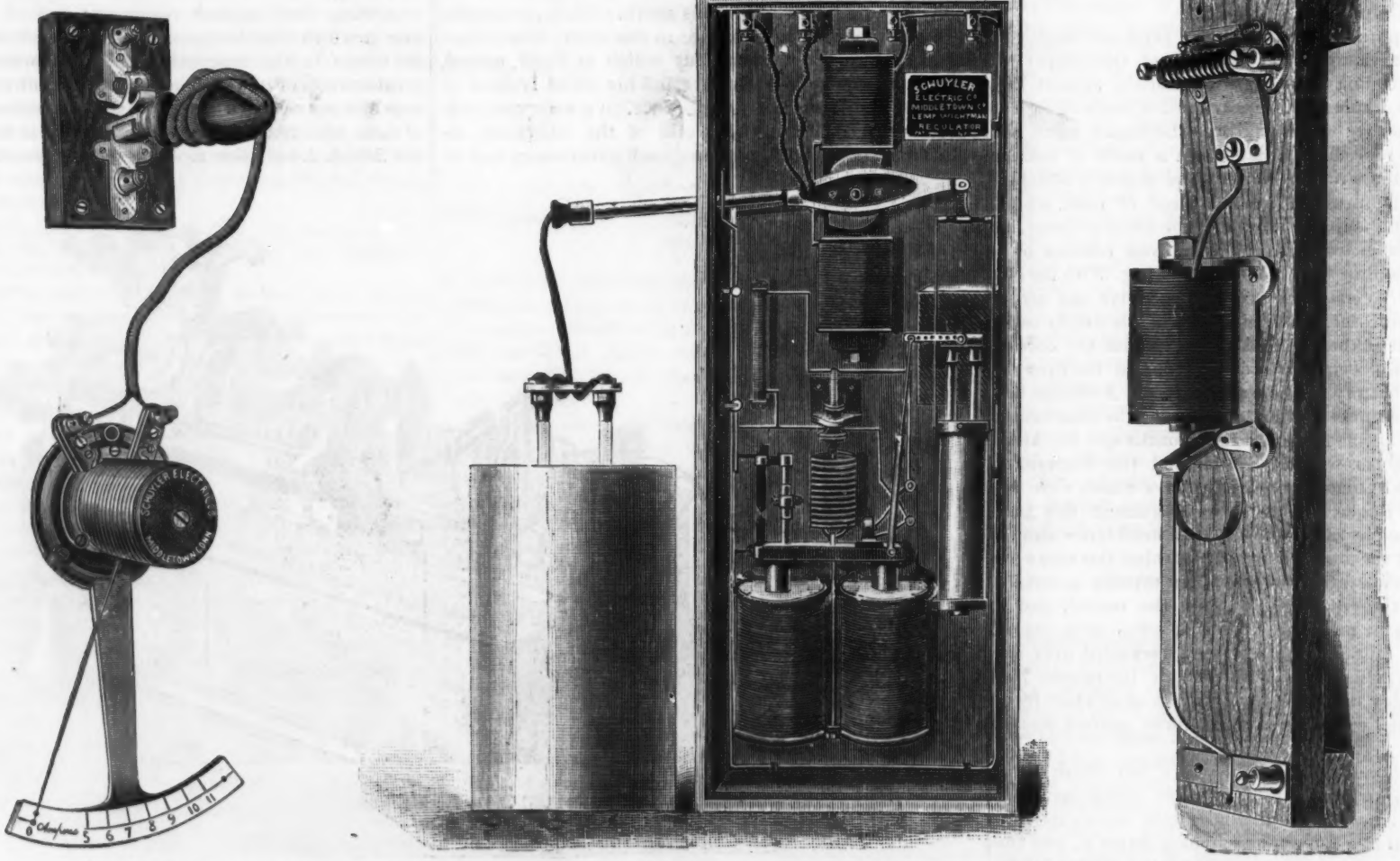
In connection with the regulator, the ammeter shown in Fig. 2 is employed. This consists of a coil which acts upon an armature attached to a spring, and registers, by means of a pointer, upon the scale placed below it. All ammeters sent out are calibrated so as to read absolutely correct.

The illustration, Fig. 4, represents one of the Schuyler lightning arresters. They are used in pairs, one being connected to the negative and the other to the positive side of the dynamo. The binding post at the lower end is connected to a good common ground. The line enters at one of the upper binding posts and the dynamo connection at the other.

These two binding posts are joined by a spiral cylinder which passes over a brass plate, so adjusted by screws as to leave a space of $\frac{1}{16}$ to $\frac{1}{8}$ of an inch between the spiral cylinder and the plate. To this plate is attached one end of the magnet wire, the other end being connected to a metal spring attached to the front of the armature, which also carries a metal strip to the lower plate and thence to ground.

The lightning passes from the spiral cylinder to the plate, through the coil and thence through the metal strip to ground. But the dynamo current follows it and instantly energizes the magnet and attracts the armature which raises the metal strip, making a break at the ground plate, and thus rupturing the arc formed at the spiral cylinder. The stroke having passed, the armature immediately returns to its normal position and is ready for operation again, being automatic in all its action.

In addition to this, the company have designed a number of new accessories in the way of cut-outs, hanger boards, and the like.


SCHUYLER ELECTRIC CO MIDDLETOWN CT LEMP LIGHTNING REGULATOR
SCHUYLER ELECTRIC CO MIDDLETOWN CONN
0 Amperes 5 6 7 8 9 10 11

FIGS. 2, 3 AND 4.—NEW SCHUYLER AMMETER, REGULATOR AND LIGHTNING ARRESTER.

Meeting of the American Institute of Electrical Engineers.

The twenty-eighth meeting of the Institute, and the first of the present season, will be held at the House of the American Society of Civil Engineers, 127 East 23d street, on Tuesday, Oct. 9, at 8 o'clock P. M. The programme of the evening will be the discussion of Mr. Frank J. Sprague's paper on "The Solution of the Municipal Rapid Transit Problem," which was read at the last special meeting of the Institute, June 19. Messrs. M. B. Leonard, of Richmond; George W. Mansfield, of Boston, and Robert W. Blackwell, of New York, have signified their intention of discussing the paper, and other members who have made a study of the subject will be present and participate.

The Corrosion of Lead Pipes.

The extensive use of lead-coated wires renders the question of the corrosion of lead when exposed to atmospheric and other influences of importance to electricians. Prof. Carnelly and Mr. Frew, of University College, Dundee, have arrived at the conclusion that in lead pipes carrying water corrosion is much greater when the pipes are exposed to the air. The corrosive action of water is diminished to about one-fourth, and that of slaked lime to one-fifth, when air is excluded. The corrosive action of blue clay and aluminium hydrate is, however, increased somewhat by excluding the air. Calcium carbonate, old mortar, calcium silicate, and a mixture of calcium carbonate and sand are not much affected in their corrosive power whether air be excluded or not. With potassium nitrate, however, the exclusion of air is important, since it becomes about as protective as calcium silicate when air is kept out, and as corrosive as water when exposed to air. Slaked lime is a powerful corroder, whether air be excluded or not. Peaty soil exerts a slight protective action on lead pipes. Sand, calcium carbonate, old mortar, calcium silicate, and a mixture of sand and calcium silicate exert a protective influence. The amount of silica in soft water reduces its corrosive power: and silica can be readily supplied to the water by passing it over a mixture of flints and limestone. A *mixture* of calcium carbonate and sand is better than either alone, perhaps by the formation of calcium silicate. Hence also, perhaps, why *old* mortar is better than new in point of protective proprieties. The protective action of magnesium oxide is also very remarkable, being nearly equal to that of calcium silicate.

Electricity at the Cincinnati Centennial Exposition.

Following the example of all the latest exhibitions, the Cincinnati Centennial depends almost exclusively upon the electric light as its method of illumination. The electric light plants erected for the purpose are quite extensive, and are distributed among a number of different systems. Beginning first with the arc, there are over 500 of these distributed throughout the building and grounds, which are fed by eight 30-light machines of the Western Electric Company, driven by a Buckeye engine, and also eight 30-lighters of the Waterhouse Company, driven by an Atlas engine. The incandescent plant comprises two Edison 600-light machines, two of the Mather type of 500 lights each, and two machines of the Queen City Electric Company, of Cincinnati, of 500 lights capacity, driven by a Ball engine. The lights connected to these machines are used for general illuminating purposes, and do not include those intended for decoration and artistic display. For this purpose a separate plant of Edison machines is provided, which furnish current to several thousand lamps distributed in the most novel effects, such as a rainbow, the scintillating fountains, revolving illuminated flower beds and other effects.

Among the motors exhibited we notice that of the George F. Card Manufacturing Company, of Cincinnati. The current for this exhibit is generated by a 5-light Waterhouse dynamo. This drives a one-h. p. Card motor of new design, which in turn drives a ventilator. The current then passes into a 1 h. p. motor, driving an upright column fan, and then energizes a 2 h. p. motor which is geared direct to a dynamo that furnishes 15 incandescent lamps; finally there is shown a ½ h. p. motor driving a sewing machine. This exhibit is very tastefully arranged and shows the application of the motor in a most striking manner.

The Spangenberg Electric Company, of Cincinnati, also show in the Canal building a dynamo running 75 incandescent lamps. This machine is neatly built and has been designed by Mr. O. C. Spangenberg, the electrician of the company.

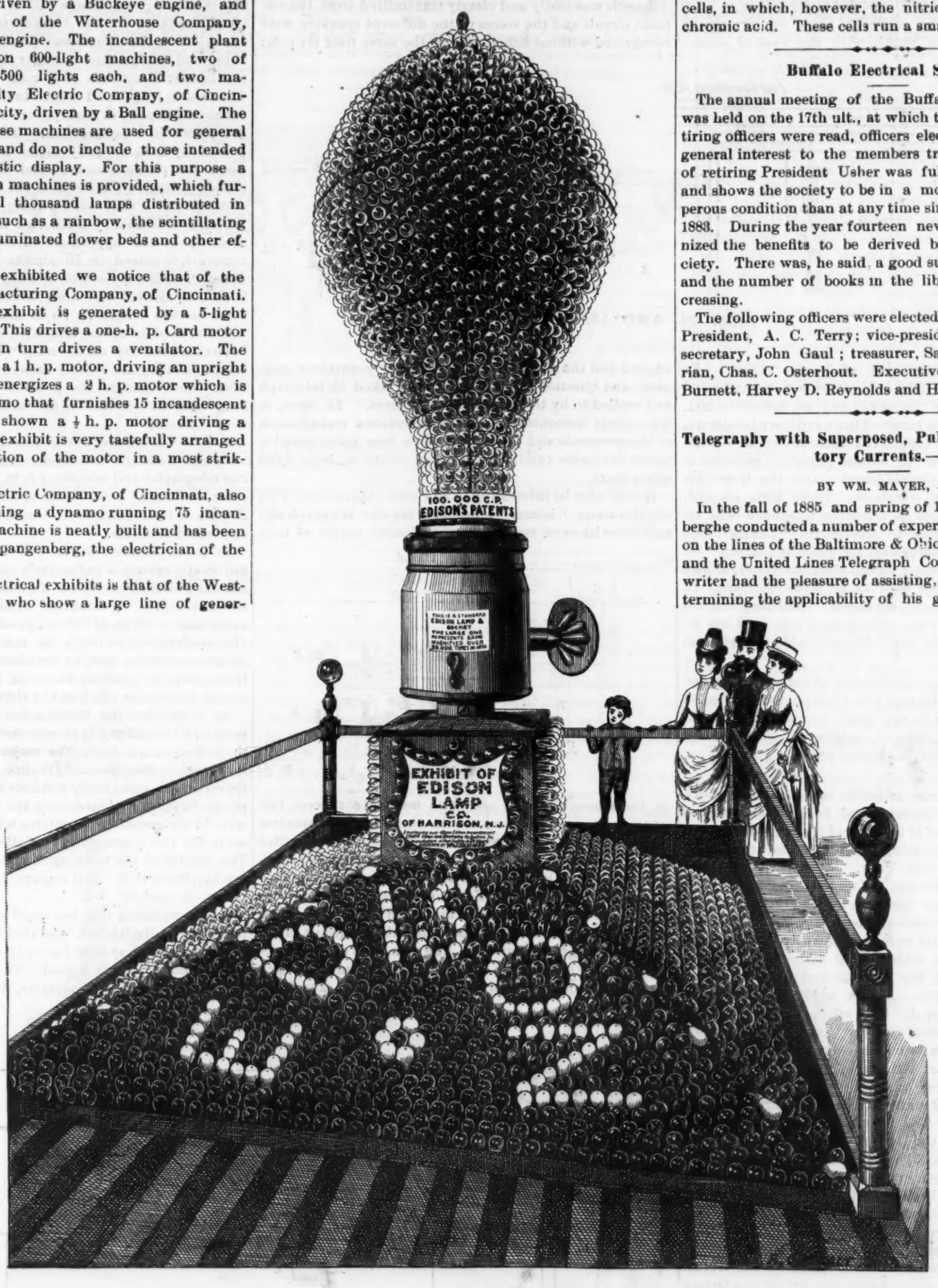
Among the other electrical exhibits is that of the Western Electric Company, who show a large line of general supplies made by them and a focussing lamp for use on shipboard. The Hill Electric Company, of Cincinnati, also exhibit their annunciator and bell work.

One of the exhibits that attracts considerable attention is the Government envelope machine, which pastes and folds envelopes at the rate of many thousands per hour, and is driven by a Mather 2 h. p. motor placed beside it. The model roller mill exhibited by the Nordyke & Marmon Company, of Indianapolis, is driven by an Indianapolis Jenney dynamo run as a motor, which operates the entire mill that reduces the wheat to the finest grade of flour.

Messrs. C. E. Jones, of Cincinnati, also exhibit general electric and telegraph supplies, and also an 18-light dynamo, driven by a 2 h. p. Mather motor. Several of the novel lighting effects, designed by Mr. W. J. Hammer, are also operated by Edison and Sprague motors.

One of the most unique exhibits in the Exposition is that of the Edison Lamp Company, of Harrison, N. J. As shown in the accompanying illustration, it consists of a huge Edison lamp and socket, mounted on a pedestal, the whole standing some thirty feet high, and the entire lamp and pedestal being composed of over 15,000 Edison incandescent lamps, each lamp being perfect in every respect. The lamps range in size from the tiny pea lamp of ¼ candle power to 150 candle power, the whole representing a value of over $10,000.

To place fifteen thousand such lamps is quite a task, and when each of the outside lamps has to be placed so as to protrude through the meshes of the wire netting, and when each lamp on the pedestal requires an augur hole bored for it, and there are some four thousand of them, it is not surprising that it took weeks to arrange this exhibit. The socket which holds the huge lamp is a bronzed sheet-iron counterpart of an Edison key socket standing about three feet high. Hanging in front of this is a standard Edison lamp and socket with a card attached, which reads: "This is a standard Edison lamp and socket; the large one represents the same magnified over twenty thousand times;" below this on the square portion of the pedestal is a shield with an inscription, the large lettering being composed entirely of ¼-candle pea lamps and small 1 and 2-candle lamps. Below this is shown the sloping foundation of lamps, on the front face of which is the name "Edison" in huge letters of opal lamps. The whole exhibit is inclosed by a wire netting, and the posts at the corners are topped with 150 c. p. lamps. The name Edison can also be flashed letter by letter and together, while inside the big lamp and under the base are placed powerful colored lamps which can be flashed, producing a beautiful effect. This exhibit was designed and arranged for the Edison Lamp Company by Mr. W. J. Hammer, who also designed and constructed the elaborate display of novel electrical effects for the Centennial Exposition.



MAMMOTH EDISON LAMP AT CINCINNATI CENTENNIAL EXPOSITION.

The Use of the Electric Light in Fishing.

Many attempts, says *Engineering*, have recently been made to employ the electric light as a means of attracting fish to a particular place so as to facilitate their capture. The arrangement generally adopted has been to plunge an incandescent lamp in the water, connection being made by leads with some source of electricity on board the fishing craft. When, however, this arrangement is adopted in deep-sea fishing, it is found that the mains to the lamp are very liable to foul the fishing appliances or the cable of the vessel. In short, it has been found impossible to maintain a permanent communication with a lamp plunged to a considerable depth below the surface of the water. M. Paul Regnard has got over this difficulty by adopting a lamp worked by a primary battery, the whole of which can be tossed overboard and reclaimed at some future time. The battery used consists of six Bunsen cells, in which, however, the nitric acid is replaced by chromic acid. These cells run a small Edison lamp.

Buffalo Electrical Society.

The annual meeting of the Buffalo Electrical Society was held on the 17th ult., at which the reports of the retiring officers were read, officers elected and business of general interest to the members transacted. The report of retiring President Usher was full of encouragement, and shows the society to be in a more healthy and prosperous condition than at any time since its organization in 1883. During the year fourteen new members had recognized the benefits to be derived by belonging to the society. There was, he said, a good surplus in the treasury, and the number of books in the library was steadily increasing.

The following officers were elected for the ensuing year: President, A. C. Terry; vice-president, Wm. H. Dopp; secretary, John Gaul; treasurer, Samuel Stewart; librarian, Chas. C. Osterhout. Executive Committee: Geo. A. Burnett, Harvey D. Reynolds and H. H. Humphrey.

Telegraphy with Superposed, Pulsatory and Undulatory Currents.—IV.

BY WM. MAYER, JR.

In the fall of 1885 and spring of 1886 Prof. Van Rysselberghe conducted a number of experiments in this country on the lines of the Baltimore & Ohio Telegraph Company and the United Lines Telegraph Company, at which the writer had the pleasure of assisting, for the purpose of determining the applicability of his graduating devices to the existing telegraph systems in vogue in this country, especially the duplex and quadruplex telegraph systems.

The first series of experiments was made on circuits between Grafton, W. Va., and Parkersburg, W. Va., which towns are 100 miles apart. There were 7 wires on the poles, all of which were equipped with "graduators," Fig. 14, page 186, in which, the condensers are not shown. Two of those circuits terminated at the point named, the others were "through" wires. The two terminating wires were used for the experiments. One of them was equipped with a regular quadruplex system, the other was operated as a single Morse circuit. It was found that telephony could be carried on with a single wire, but the best results were secured by using a metallic circuit, as seen in the figure. The experiments proved that on these shorter circuits the ordinary graduating devices employed in Europe could be used without serious detriment to a quadruplex system of the above length, but their introduction necessitated a large increase in the electromotive force above what i_g generally required on circuits of similar length. On the adjoining through quadruplex circuits, however, the effect of the presence of the graduators in the circuit was detrimental, and they had ultimately to be very considerably modified, as to their capacity, before they could be used without injury to the quadruplex service.

The arrangement of electro-magnets and condensers finally adopted for the experiments is shown in Fig. 15, page 186, in which $E\,E$ are electro-magnets of 150 ohms each, and $C\,C'$ are condensers of about ¼ microfarad each. $N\,R$ and $P\,R$ are the neutral and polar relays of a quadruplex system.

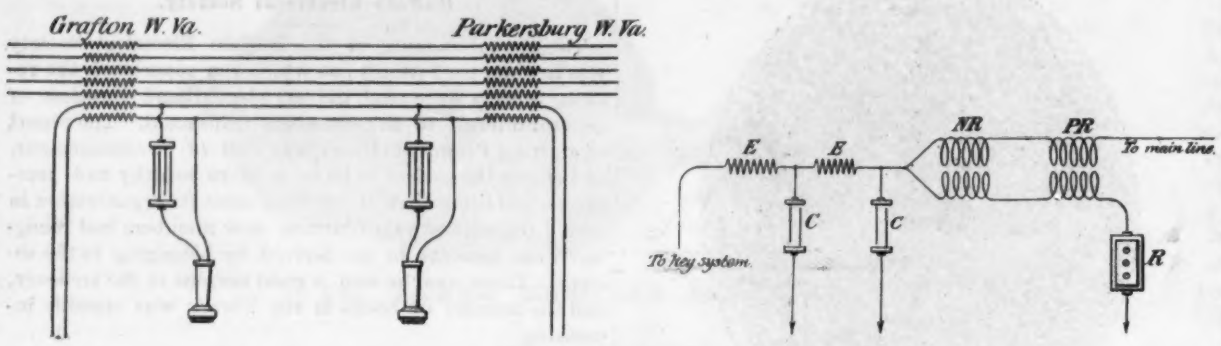
With this radical modification of the graduators it was possible to work quadruplex circuits of about 300 miles in

length, but not without some loss of efficiency; and an increase of ten per cent. in the electromotive force was requisite to restore the working margin of the No. 2 side of the quadruplex to a successfully operative condition.

These modified graduators did not nearly remove the noises in the telephone due to the make and break of the telegraph currents, but it rendered them tolerable.

During many of the experiments, the parallel wires on which currents of high E. M. F. were employed were not equipped with "graduators," and consequently the induction from them precluded successful telephoning.

A series of tests was, however, made on circuits of from 250 to 300 miles in length, with the view of superimposing pulsatory currents upon quadruplex circuits. In these experiments the pulsatory currents were originated by a vibrating fork or "buzzer" and an induction coil, and were intended to be received in an ordinary telephone. The results were not considered satisfactory, it having been found difficult thus to obtain pulsatory currents of sufficient force to be plainly heard above the induction noises in the distant telephone. These tests showed, among other things, that a sensitive telephone was, on the whole, better adapted to receive the "buzzer" tone than a less sensitive instrument, for while it took up "induction" noises to a greater extent than the latter, it also delivered the buzzer tone with much more clearness. In other words, as between increased "induction" noises and more pronounced tone, or decreased tone and less induction, the former was decidedly preferable for practical purposes.



FIGS. 14 AND 15.

Some very interesting experiments of extreme long distance simultaneous telegraphy and telephony were made at about the same time on the large compound wires of the Postal Telegraph Company, a distance, as the wires run, of about 1,010 miles. Resistance of wires 1.3 ohms per mile.

To avoid induction from adjacent wires in New York City and Chicago, the experimental offices were located at a point five miles out of the city of Chicago, and at the North River cable crossing of the Postal Company, Seventy-second street, New York.

It was intended to attempt the feat of transmitting articulate speech, and four messages by telegraph, over the the same wires, simultaneously, between New York and Chicago, and the circuits were consequently connected up as shown in Fig. 16, in which *N R* is the neutral relay, *P R* the polar relay, *R* the rheostat and *c* the condenser of the quadruplex system. *K* is a key, and *R'* the relay of a single Morse circuit *A*. *G G'* are the electro-magnets, and *C C'* the condensers of the Van Rysselberghe unmodified graduators. *S C* is a condenser of about 3 M. F. capacity, one of whose terminals is attached to the "single" wire *A*, the other being connected to the quadruplex wire *B* after passing through the telephone apparatus. The telephone apparatus and connections are shown at the right of the figure. These connections correspond to those in use on the Van Rysselberghe system in Europe, except as to the arrangement of the graduators, which is slightly different. *I* is an induction coil. *S* represents the transmitter battery, in this case a storage battery cell. *M* is a microphonic transmitter. *V* is a vibrating diaphragm which operates the call-bell *C B*. This vibrating diaphram is used in place of the vibrating bell on account of its greater sensitivity. *B'* is a buzzer which, when the key *K'* is depressed, actuates the distant vibrating diaphragm. As the connections at both extremities of the line were the same, it will be seen that the telephonic circuit was practically a metallic circuit, composed of the wires *A* and *B*, the object of the insertion of the separating condenser *S C* being, of course, to give the telephone the advantage of the round circuit without short-circuiting the two telegraph circuits.

It will not be necessary to give more than a passing explanation of the telephone connections. Normally the telephone is suspended from the hook *H*, and at such times the vibrating diaphram *V* is in circuit ready to be operated by the distant buzzer. The battery *S* is open at *x'*, and the telephone *F* is out of the circuit. The distant station is "called" by depressing the key *K'*, which operates the distant vibrating diaphragm. It will be seen that the battery *S* is used as the "buzzer" battery as well as the transmitting battery.

During the experiments, which extended over several nights, it was found that the No. 2 side of the quadruplex could not be operated at all successfully owing to the extreme retardation of signals. due to the presence of the graduators in the circuit, and, therefore, the telegraph portion of the "metallic" circuit was worked only as a polar duplex, which it did admirably. All the adjoining circuits were "graduated" throughout.

The experiments were not begun until 8 or 10 o'clock each night, and, consequently, the "induction" from "foreign" parallel lines was much diminished, and at about midnight even this died out, leaving the conditions for the tests all that could be desired.

Speech was easily and clearly transmitted over the metallic circuit and the voices of the different speakers were recognized without difficulty. At the same time the polar duplex and the single wire were being constantly operated, and question after question was asked by telegraph and replied to by telephone and vice versa. In short, it was clearly demonstrated that simultaneous transmission of Morse signals and the human voice was quite possible under favorable conditions between points at least 1,000 miles apart.

It may also be interesting to add that experiments with simultaneous "buzzer" tones and regular telegraph signals were likewise made during the same series of tests

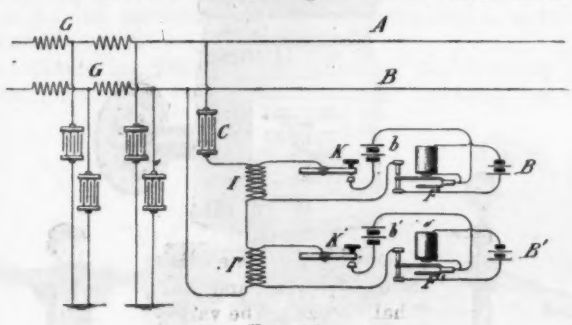
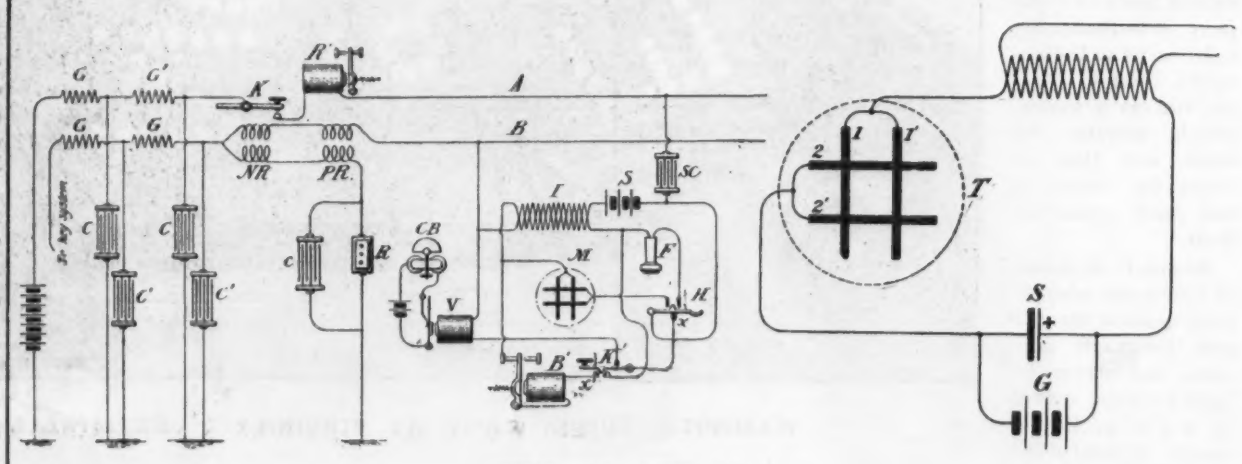


FIG. 17.

on these long circuits, and with moderate success, two separate tones being received in the telephone receiver while telegraph signals were at the same time transmitted over the same circuits. The arrangements for this experiment are shown in Fig 17. *C* is the separating condenser. *A* and *B* are circuits New York to Chicago, equipped with graduators *G G*. *I* and *I'* are induction coils, the secondary coils of which are in the "metallic" circuit *A*, *B*, formed through condenser *C*. The primaries of the induction coils are in separate local "buzzer" circuits, in each of which circuit is a tuning fork *F F'*, and key *K K'*.



FIGS. 16 AND 18.

A separate battery *B B'* is used to operate each form in the well-known way, and another battery *b b'*, charges the induction coils. The keys *K K'*, as may be seen, when open only interrupt the primary circuits of the induction coil, and the fork is permitted to vibrate continuously. The receiving telephones are not shown.

It will be understood that in the reception of the double "tone" signals in one telephone receiver each receiving operator has to confine his attention to a predetermined tone, and read the signals transmitted by that tone alone, disregarding the other. This can be done with a little practice. In the case in point two separate "tones" were received from Chicago and two also from New York, but not simultaneously. For, to do this, some means would have had to be devised to render the transmitted tones inaudible in the receiving telephone. This it was found impracticable to do entirely, by using either the differential or bridge method. With these methods and the somewhat crude apparatus employed in the experiments the sound remaining from the home transmitter was as loud as or louder than that received from the distant station.

Fig. 18 illustrates more specifically the microphonic transmitter and battery used in the Van Rysselberghe system, excepting that in some instances the storage battery *S* is replaced by large Leclanché cells. The storage cell is charged by three gravity cells *G*, as shown. The object in using the storage cell is mainly to obtain diminished resistance in the transmitter circuit, so that the variations in the transmitter points may have a greater value and thus produce stronger telephonic signals. The transmitter *T* consists of 4 rods of carbon each about 4 inches in length and .5 inch in diameter. Two rods are connected in pairs in multiple arc as shown. The carbons are placed in a square box. The pieces 1 1' are supported by suitable projections in the box; 2 2' rest upon the pieces 1 and 1', and are held in position by simple means on the inside of the box. A circular cover, consisting of a thin hard rubber disc, the periphery of which is indicated by the dotted lines, is placed immediately above the uppermost carbons. The box, with its contents, is placed in an almost horizontal position, or, at most, with but a slight upward inclination. The voice is thrown against the disc, which communicates vibrations to the carbons. As is usual with carbon transmitters, used in connection with comparatively powerful batteries, arcs are occasionally formed in this arrangement, but they are readily broken by a slight tap on the disc, which changes the position of the carbons. As a long distance transmitter this arrangement was certainly very efficient.

It is said there are now in Europe over 13,000 miles of wire on which the Van Rysselberghe system of simultaneous telegraphy and telephony is in operation. There is no record, so far as I can learn, of any such circuits in Great Britain or in this country. One has not to look far for an explanation of this.

In Great Britain, as is well known, the Wheatstone automatic system is extensively used in telegraphy, to the almost practical exclusion of quadruplex telegraphy, and the insertion of "graduators" in circuits assigned to rapid automatic work is, of course, precluded. In this country the quadruplex system is the main reliance of the telegraph companies, and, as has already been shown, the introduction of graduators, even as radically modified, would reduce the efficiency of that system.

As to whether the 13,000 miles of simultaneous telegraphy and telephony is in successful operation in Europe there is some question. The major portion of this mileage is located in Belgium and France, in which countries the Government completely controls the telegraph and telephone business. Hence, they are enabled to equip every wire in the respective countries with graduators, if necessary, for the procurement of silence in the telephones. The reports of the working of the system from Belgium are favorable to it. But reports from other quarters are not so favorable.

It is complained that the speed of the Hughes printing telegraph is diminished, and that the electromotive force of the telegraph system has to be largely increased where the combined system is used. These results, however, are hardly fair causes of complaint, inasmuch as they must have been anticipated from the beginning. A more serious complaint, as it seems to me, but one that is not inherent in the system, is that the condensers used as separators and as graduators are very much prone to act as lightning arresters and thereby occasion not only expense for repairs, but also loss of time due to failure of both circuits. The likelihood of such occurrences was at one time mentioned as an objection to the use of the Varley simultaneous system on fire alarm and police circuits in this country, but it has been shown that it is possible to construct condensers of such quality that this objection disappears. Out of several hundred condensers in use for several years past in this country, for this and equivalent purposes, not one, so far as I can ascertain, has as yet been damaged by lightning. Perhaps the use of an equally durable condenser on the European lines would obviate this cause of complaint.

Electric Power in the Comstock Mines.

We learn from *The Mining Industry* that the Brush Electric Company has shipped to the Nevada mill two dynamos and motors of an improved pattern, that will be able to put upon the stamps 80 per cent. of the power generated at the bottom of the shaft. There are to be six dynamos, one always to be held in reserve, and six Pelton wheels 40 in. in diameter, to be made of phosphor-bronze, to drive them, each attached to the dynamo shaft direct. These wheels will be set up at the Sutro tunnel level of the Chollar mine, in a large chamber already prepared to receive them. A column of water brought down the side of Mount Davidson in a wrought-iron pipe will be delivered through a proper nozzle upon the surface of the Pelton which stands in the mill, under a perpendicular pressure of about 460 feet. This wheel is 10 feet 10 inches in diameter. After the water leaves the wheel it is piped to the main shaft of the Chollar mine. Down this shaft (and the incline at its bottom) the water is conveyed in two pipes to the electric chamber on the Sutro tunnel level. The water will be put upon the wheels under a perpendicular pressure of 1630 feet. In no place in the world has water been used on a wheel under such a tremendous head. The water will be delivered upon each wheel through a nozzle somewhat less than half an inch in diameter. Each wheel is intended to develop about 125 h. p. This will make a total of some 750 h. p. delivered by the six wheels. As this is the first attempt in the history of mechanics to operate water-wheels under such an enormous pressure (as well as the fact of the utilization of the power by electrical transmission), the result of the experiment will everywhere be anxiously awaited.

A New Compound Condensing High-Speed Engine.

A decided departure in steam engineering has recently been undertaken by Messrs. Fairbanks, Morse & Co., of Chicago, in the construction of a high-speed compound engine, which has been specially adapted to electric lighting work.

One of these engines, which has been designed by Mr. Ed. F. Williams, is now driving a number of Edison dynamos at Edgewater, a suburb of Chicago. The engine, which is illustrated in the accompanying engraving, Fig. 1, has the dimensions:

Diameter high pressure cylinder	9¼ in.
Diameter low pressure cylinder	16 "
Stroke	16 "
Revolutions per minute	270
Diameter of driving wheel	62 in.
Face	12¼ "
Weight of each wheel	1,925 lbs.
Number of wheels	2
Diameter of crank shaft	8¼ in.
Weight of entire engine	17,000 lbs.

The floor space occupied by the engine is 16 feet 6½ inches by 8 feet 4 inches over all. The condenser and air-pump occupy a portion of the same rectangle. No receiver is used, the steam being carried as directly as possible from the high pressure to the low pressure cylinder. The high pressure steam chest is provided with two valves, one for admission, release and exhaust closure, and the other, operated directly by a shaft governor, cuts off the steam automatically. One valve only is used in the low pressure cylinder, and has a fixed point of cut-off at about half stroke. The valves are balanced by a new system of pressure plates, in which the latter are subjected to comparatively light steam pressures. This enables them to be adjusted closely upon the valves, bearing upon them until the surfaces are made true and tight by the light pressures brought upon them, and the wear occasioned by the movement of the valve.

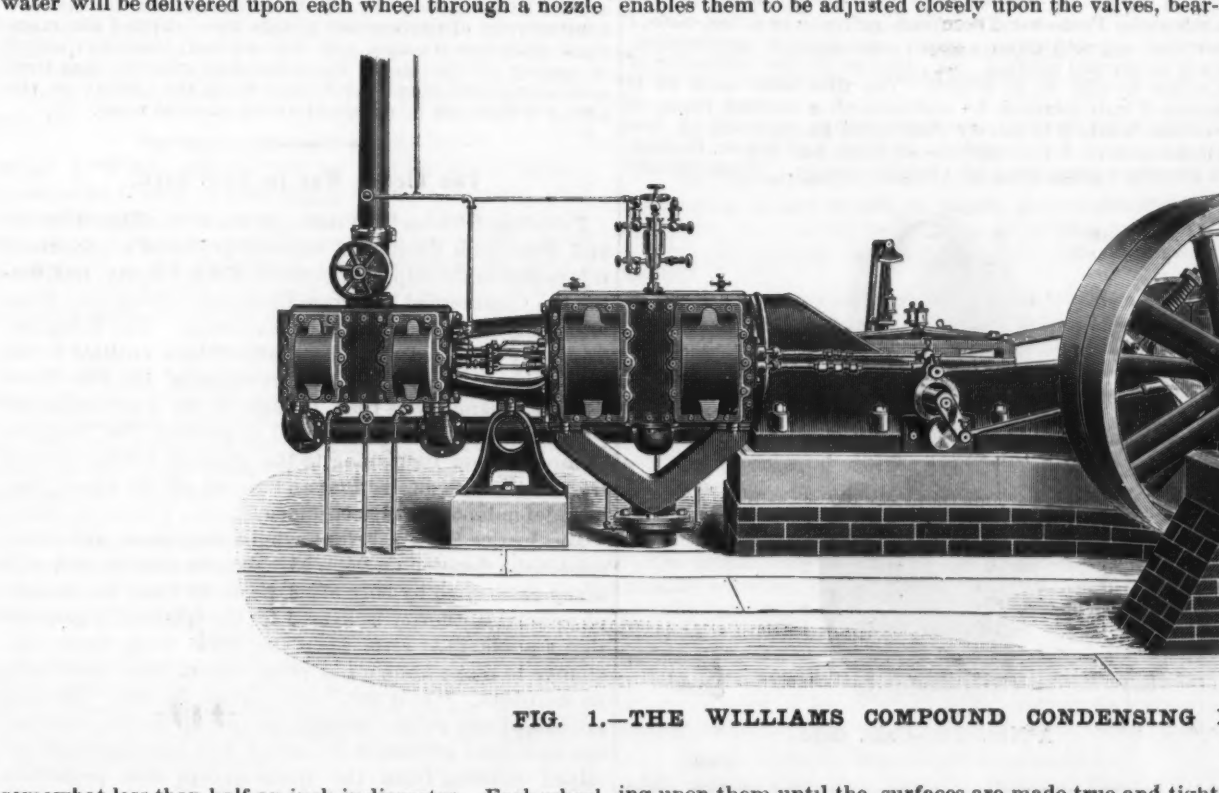


FIG. 2.—THE WILLIAMS COMPOUND CONDENSING ENGINE.

Fig. 2 shows the arrangement of the low pressure valves and pressure plates. The arrangement in the high pressure steam chest is practically the same, except that in this chest a balanced cut-off valve operates within the main valve. This cut-off valve is adjustable by tap bolts.

The live steam in each case occupies the centre of the chest, and the exhaust passes out at the ends, thoroughly separating one from the other. This is considered very important in order to prevent condensation of live steam. All the port openings are doubled, which effects a sharp action.

A feed water consumption of 18 pounds per indicated h. p. per hour has been reached under a load of 55 h. p. with 55 pounds of steam pressure. Better results are expected with higher steam and heavier loads, the engine having a capacity of 100 h. p.

FIG. 1.—THE WILLIAMS COMPOUND CONDENSING ENGINE.

Electric Lighting in America.*

BY PROF. G. FORBES, F. R. S.

I think we are probably all agreed that the old type of alternating current dynamo, such as the Siemens, has probably seen the end of its days. One of the chief difficulties seems to be that when you have such a large number of coils revolving between the poles you are obliged to make a considerable clearance, and that causes you to use up a great deal of power in magnetizing the field magnets. Mr. Westinghouse makes a very small clearance, and in that way uses up only 2 per cent. of the maximum power.

The Westinghouse Company make three types of dynamo, of which the following particulars are of interest:

Dynamo No	I.	II.	III.
E. M. F.	1,050	1,050	1,050
Current	35	65	130
Resistance (armature) at 30° C.	.76	.37	.15
" (fields) "	14.5	7.0	3.6
Weight of wire in armature	17	30	60
" " fields	420	.....	.....
Total weight	4,800	9,000	.....
No. of lights	650	1,300	2,600

The No. III. has an armature about 2 feet in diameter and 2 feet long. It has 16 poles, and runs at 1,000 revolutions per minute. The armature plates have each six large holes for ventilation and lightness. The weight of armature is 2,000 pounds. The insulation is mica and copal varnish, which is found to be infinitely superior to shellac or any other material tried.

The converters used by the Westinghouse Company are of five sizes, called by the numbers I., II., IV., VI. and VIII. The following table gives particulars about them. The size of wire is in B. and S. gauge:

Converter	I.	II.	IV.	VI.	VIII.
No. of lights	5	10	20	30	40
Wire on primary	25	22	19	17	16
" secondary	11	8	8	8	7
Turns on primary	900	700	560	480	400
" secondary	45	35	28	24	20
Resistance of primary	48	21.9	9.9	7	5
" secondary	.04	.043	.0197	.0176	.0107
Weight finished (lbs.)	50	60	95	.....	160

Thickness of iron plates, = .006 to .0065 inch.
Thickness of paper insulation = .0025 inch.
Number of plates in a No. 8 converter = 1350.
The iron used is Welsh Taggart iron.
50 degrees C. rise in temperature is allowed in the converters.

In this country the tendency is to make converters much larger; it has even been suggested that they should be made of thousands of lights. But for ordinary use in houses the Westinghouse system is the simplest, more especially as we find that it is necessary to wire the houses in such a way that they will suit our meters, which at present do not go over a range of from one lamp up to a thousand lamps, nor even up to hundreds of lamps, and if we find that our range is suitable up to 40 lamps it is very desirable to wire the houses in such a way that there are not more than 40 in the circuit of a meter indicating 40. For this reason Mr. Westinghouse has limited his converters in this way.

There are some points well worthy of attention in regard to converters. In the first place, by the use of only 1,000 volts, a far cheaper converter may be made, and thus a great saving may be effected in the plant required for a house. Then, again, there is the rapidity of alternation. In the Westinghouse plant there are 16,000 alternations, 8,000 complete periods per minute. In this country the tendency is to make the alternations less than that. The quantity of iron you put in your converters depends on the number of alternations; the greater the number of alternations the less iron is required, and you are therefore able to use smaller converters. I do not know whether or not there are objections upon other grounds to a high number of alternations. The only objection that occurs to me is that, while the construction of the dynamo sometimes becomes a little easier, it also takes a little more space.

*Abstract of a paper read at the B. A. meeting.

A Novel Electric Current Indicator.

Persons in charge of electric light stations, and especially line men, frequently have occasion to determine whether wires which they are handling carry current or not; in other words whether they are "dead" or "live," and as there is no handy method of determining this ordinarily, some simple means of doing so is of considerable value in many cases. To meet this want Mr Patrick B. Delany, has recently devised a simple arrangement, in the shape of a ring which is worn by the operator, and which contains a small compass needle, shown in the accompanying illustration. By placing the ring in proximity to a wire, the deflection of the needle will at once show whether the wire be carrying current or not. Another method consists in filling the bezel of the ring with iron filings, the attraction of which by the action of the current also serves to show the presence of the same.

A New Two-call Bell.

It is frequently desirable to operate a call bell from two different points, and to be able to determine from which point the signal has been sent. In order to effect this Mr. Chas. E. Lee, of Rochester, N. Y., has designed the bell shown in the accompanying engraving, which is so arranged that a call sent in from two different stations is recorded by the indication of two annunciator windows placed in the same and distinguished by black and white screens. The apparatus is operated without clockwork, and does not require to be reset after an indication.

Alternating vs. Direct Currents—A Rejoinder to Mr. Brown.

BY P. H. VANDER WEYDE.

Mr. Harold P. Brown, in his defense against my criticisms on the experiments made by him during his public lecture, begins with giving the official report of further experiments made afterward before members of the Board of Health, which report, as he states, has not been published by any of the electrical papers, and which he therefore allows that I had not heard of. This is so; my remarks were the simple result of the impressions I received while attending the lecture to which I had been invited. For my part, I am ready to allow that if I had been present at the subsequent experiments my impressions might have been different, but because of the way our controversy stands now, I have to confine myself to what I have seen and commented upon.

Before going into a specific consideration of Mr. Brown's attempt "to set me right in matters in which I am greatly mistaken," I wish to state that I am in no way whatsoever connected with any alternating current interest, as he insinuates neither am I interested in introducing a "new and peculiar converter." This apparatus was simply made by me as a tool for further researches of my own. It is based upon the peculiar form of Roberts' powerful electromagnet (see Sturgeon *Ann. of Elec.*, vol. 6, p. 166) which I made some thirty years ago, and which, by evolution, was changed first into a current generator for telegraphic purposes, and recently into a converter.

I wish also to state that circumstances caused me to write down my impressions in haste, and that from my first rough draft copies were made in typewriting and delivered without my knowledge; the editors of THE ELECTRICAL WORLD, in their praiseworthy desire to give an early report of the meeting, had my paper in type before it was read, and in which I had corrected some of the statements to which Mr. Brown objects. It was only on the day after the reading of the paper that I found this out, and all that I could do was to correct some clerical errors in the figures. I was informed afterward that other type-writer copies were in the hands of Mr. Frank L. Pope, and calling at his office and communicating the circumstances to him, he requested me to correct one of these for his paper, the *Electrical Engineer*, which, being a monthly, allowed time for correction, while I gladly accepted the opportunity to obtain a record of my paper as I intended it to be. The number of THE ELECTRICAL WORLD containing Mr. Brown's defense reached me yesterday by the same mail as the *Electrical Engineer* containing the corrected version of my paper, of which, however, the bearing remains practically the same, namely, to show that the experiments exhibited at Mr. Brown's public lecture were not conclusive to prove that the voltage of the alternate current used was not higher than it was estimated, or what the instruments appeared to indicate, which doubt is based upon the use of an entirely different principle in the measuring instruments of either current.

In regard to these, Mr. Brown asks me to tell him wherein voltmeters of the ordinary type differ from ammeters, except in their resistance and calibration. I will satisfy his request by saying that the principal difference is in the number of convolutions of the conducting wire; while ammeters have only a few, one or even half a convolution, the number of convolutions of the voltmeter run in the hundreds and thousands, by which the magnetic action of the electromotive force upon the galvanometer needle or upon the moveable iron core is multiplied. The greater resistance of the voltmeter is simply a necessary consequence of this.

If the difference were one of resistance solely, we might as well substitute a single high resistance loop of very thin German silver wire for the low resistance copper strip or bar of the ammeter, in order to change this into a voltmeter.

Mr. Brown advises me to write for information to "Professor Forbes, who has time to keep posted on current inventions." Well, I saw Professor Forbes when he exhibited his ammeter, or rather coulomb meter, before a meeting of the American Institute of Electrical Engineers, where I pointed out to him some grave defects in his apparatus, as well as the manner in which it could and should be corrected. My remarks were indorsed by many members present, but, as is commonly the case, not by the inventor.

I may not have "time to keep posted on every current invention," but I have had time to construct and experiment with voltmeters based on rise of temperature, which labor has caused me to lose confidence in voltmeters based on that principle. When I can be shown a voltmeter of this class which will indicate 80 volts when on a current of 24 large Daniell cells connected in series, and only one volt when on the current of a large coiled up Wollaston plunge battery, of, say, a few metres square surface (as will be the case when using a voltmeter with a magnetic needle), I will be convinced that the caloric principle can be applied to voltmeters. However, as far as my experiments have gone, I have found that the direct indications of such voltmeters are only correct when used in circumstances similar to those under which they have been calibrated, and that under other conditions the indications have to be corrected by taking in account the mutual relations of the external resistances to those of the internal resistance of the battery or current generator employed, and of the measuring instrument itself.

I expected I would be taken to task for heresy in regard to my want of faith in caloric voltmeters, even when they have been invented in England. What are they? Nothing but metallic thermometers calibrated for voltage. I abandoned the use of such thermometers long ago, as I found them, by reason of their necessary mechanical complication (pivoted gearing, etc.), more or less unreliable, frequently failing to return to the starting point when allowed to cool down, in the course of time changing their indication entirely, etc.; hence my unfavorable opinion about them, and all contrivances based upon the principle. However, when well made and carefully used, they may, when graduated as ammeters, give tolerably correct readings, even for currents of great quantity; but when graduated as voltmeters they are subject to the difficulty that there is a great difference in the caloric capacity of currents of high electromotive force with low quantity of current, and the reverse circumstances, so that an instrument graduated by very high voltage and low current cannot give correct readings for low voltage and high current.

A NOVEL CURRENT INDICATOR.

I had heard of Cardew's voltmeter, but only from the meagre account given in Prof. S. P. Thompson's book, referred to by Mr. Brown. In looking up some of the authorities Professor Thompson refers to in a foot-note, I see that my objection against complicated mechanism, such as pivoted gearing, etc., applies to the voltmeter of Cardew as well as to others. The fine wire used in it makes it only adapted to currents of a limited range of voltage, while it is utterly unadapted to currents of low electromotive force, such as 30 volts and below, because it absorbs a great deal of electric energy. Consequently there is great uncertainty at the lower end of the scale, while at the upper end the uncertainty is so great that the inventor found it necessary to double the resistance as soon as the voltage reached 120 volts, and then attach another scale to read the volts for this higher resistance.—(See Ayrton's "Practical Electricity," London, 1887, p. 427.)

A NEW TWO-CALL BELL.

Another question must be settled also, namely: How far is the caloric effect of a current influenced when the same direct current is caused to alternate. Will not the alternation reduce the caloric effect and consequently indicate a lower voltage, when a voltmeter is employed, based on the principle of rise of temperature? Some of my experiments seem to point this way. I say *seem to point*, as my tests have not been made with sufficient frequency to settle the point in my mind, but I recommend investigation of this kind to those interested.

Electric Protection.—The local Prohibitionists were ordered to remove the big Fisk and Brooks' banner at Broadway and Thirty-fourth street, that was complained of as a nuisance. The managers of Gen. Fisk's headquarters promised to removed it but it is still floating, a lot of live electric wires being fastened to the pole to prevent its being taken down.

The Specific Resistance of Pure Copper.*

BY WALTER T. GLOVER.

The introduction of the electric light, whilst effecting many improvements in electrical manufactures, has in one essential particularly aided in developing an improvement which had already commenced and which had been principally initiated and carried on by the development and extension of submarine telegraphy. The increased length of submarine cables, drawing attention to the necessity of decreased resistance in the conductor employed, naturally brought with it as the result of most careful testing, a more perfect system of smelting, and the production of a quality of copper of greatly increased purity, as this necessity became apparent and was insisted on. Whilst the original cables submerged in 1853-4 between England and Holland had a conductor consisting of solid copper wire, with a conductivity of about 50 per cent. of pure copper, the latest form of submarine cables now possesses a conductor equal to and exceeding 96 per cent. of pure copper.

The special attention given to the electrical qualities of the copper wire used for telegraphic and telephonic external work has tended in the same direction of obtaining a material of greater electrical efficiency, and lastly the electric light has still further added a strong stimulus to the smelter and to the wire manufacturer to produce a metal of the best possible conductivity. It can be well understood of what great importance a difference of two or three per cent. of conductivity of an electric light cable would make in the economical working of an installation. An increase in the resistance of an electric circuit of two or three per cent. may practically be assumed to mean a corresponding increase in the cost of the production of the motive power, and an increased item of the general expenditure for maintenance.

The lowness of the conductivity of the copper conductor must be met by the increased cost of construction by employment of a larger conductor, or by the increased cost of maintenance. These results have, however, been avoided by the great improvements in manufacture, whereby a material is now produced of a much higher specific conductivity than was formerly thought possible for ordinary commercial use.

This result has produced an apparent anomaly, for it is now not unfrequently the case that "hanks" of copper wire are manufactured which, on undergoing careful tests for conductivity at the works where they are to be used, are actually found to possess a *higher conductivity* than that assigned to absolute pure copper of the same gauge.

Numerous instances of this fact were given by Mr. Willoughby Smith in a communication addressed by him to the Society of Telegraph Engineers and Electricians some time back, in which some samples came out 4 per cent. in excess of the standard of pure copper.

If these were isolated cases it would not be immaterial to suppose that some error had occurred in the tests; but similar observations have so often been noticed that one is inevitably led to the conclusion that the standard usually accepted as that represented by pure copper must be an erroneous one, and one which should require recalibration.

A reference to various text-books, tables, etc., all show that while a certain amount of difference exists in the various standards given, as the base of the tables, there is a general unanimity in describing the standard as obtained from determinations by Dr. Matthiessen. The experimental investigations by Dr. Matthiessen into the specific conductivity of the various metals were carried out more than fifteen years ago, and it is evident that the quality of purity of the metal experimented with at that time was, as regards copper, different from the quality or the purity which can be obtained at the present time.

The Ticker War in New York.

President Charles G. Wilson, of the Consolidated Stock and Petroleum Exchange, recently procured a temporary injunction in the Supreme Court of Kings County, restraining the Commercial Telegram Company, of this city, from removing its tickers from the Exchange. The Telegram Company admitted that the plaintiff was entitled to the injunction. James D. Smith, President of the New York Stock Exchange, was then brought in as a defendant on the allegation that it threatened to prevent the Telegram Company from furnishing to the plaintiff information of the transactions on its floor and to cut off its wire. The new defendant was also enjoined.

Mr. Justice Brown, before whom the cause was tried, rendered a decision on Sept. 25. After a careful review of many cases cited by both sides, he finds that the weight of judicial authority is averse to the plaintiff's position that a public duty rests upon the New York Stock Exchange to make known the price of securities dealt in by its members. "It is not," says Judge Brown, "the outgrowth of any public demand, serves no public interest, has no special privileges or power, and has asked and obtained nothing from the State except that protection which the law affords to every citizen, and exists solely for the purpose of affording its members facilities for the transaction of their individual business. * * * The business is exclusively that of the individual members; and nothing, I take it, can be clearer than that the parties to a sale of property have an absolute right to keep the facts and details of that transaction to themselves, and to deny any information relating thereto to all the world, and that there is no power in the courts under our Constitution to compel them to make the same public. * * * Applying this conclusion to the parties to this case, the plaintiff has shown no cause of action against the Stock Exchange and, as to it, the complaint must be dismissed. But no issue is made by the answer of the Telephone Company and, as to it, an injunction must be granted in accordance with the prayer of complaint." The case will be appealed.

* Abstract of paper read before the British Association meeting (Section A), at Bath, September, 1888.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Oct. 1, 1888.

Work of the Sprague Company.

I learn that during the last week the Sprague Electric Railway and Motor Company, of New York, has closed a contract with the Pennsylvania Railroad for an electric motor and gearing for a transfer table at Altoona, Pa. This table is supplied by the Yale and Towne Manufacturing Company. The electric power reaches the table from an overhead wire from a dynamo located in the main engine-room of the shops, distant about 900 feet from the table. The motor will move weights of 100,000 pounds at a rate of 300 feet per minute. The Sprague Company some time ago put in a similar plant at Aurora, Ill., for the Chicago, Burlington & Quincy Railroad, and the successful operation of this installation, I understand, has been the direct cause of the order from the Pennsylvania road.

Since your last issue the Sprague Company has put another street railway into commercial operation. This is the Hartford & Wethersfield Street Railway, of Hartford, Conn. Among those present at the trial trip the other day were: President Goodrich, Messrs. Roland Mather, Henry Keney, Charles L. Lincoln, Atwood Collins, Samuel G. Dunham, Daniel Howe, Judge Henney, Mr. A. P. Pitkein, Mr. Ebenezer Roberts, Alderman Henney, and Selectman Horace Robbins, of Wethersfield.

Starting from the depot at 4 o'clock, the run down was made in twenty minutes without any special attempt at speed. The return trip was made in eighteen minutes. The trial was perfectly satisfactory to the directors, who expressed themselves as well pleased with the easy motion of the car in starting, rounding curves and in speeding. The trip to Wethersfield was made two minutes ahead of schedule time, and the return trip was accomplished in six minutes less than the regular time. The following afternoon Mayor Root and several members of the Common Council and Board of Street Commissioners accepted the invitation of President Goodrich and went to Wethersfield in the electric cars. It is expected that the new cars will begin their regular trips next week.

Removal.

The Callender Insulating and Waterproofing Company have removed their offices to the new Telephone Building, No. 18 Cortlandt street, this city.

Upright Boilers for Electric Light Plants.

The Hazelton upright boiler appears to have found considerable favor with the electric light people. One of 215 h. p. has been put in by the Schuyler Company of Newark; three of 215 h. p. by the United Company of Springfield, Mass.; two of 150 h. p. by the Meriden, Conn., Electric Light Company; one of 215 h. p. by the New Britain, Conn., Schuyler Electric Light Company. The company, of 716 East Thirteenth street, this city, are making quotations on 500 h. p. boilers, although I believe that vertical boilers have not heretofore been working successfully much over 100 h. p.

Leather Link Belting.

Chas. A. Schieren & Co. report recent sales of their leather link belting to the following concerns for use on dynamos: Lockport Gas Light Company, Lockport, N. Y.; White Plains Electric Light Company, White Plains, N. Y.; T. Hawley & Co., Bridgeport, Conn.; City of Ypsilanti, Mich.; H. L. Childs & Co., Pittsburgh, Pa.

The Magnesia Sectional Covering.

Robert A. Keasbey & Co., of 58 Warren street, report that orders are flowing in quite briskly for their magnesia sectional covering for steam pipes, boilers, etc. During the past week they have closed contracts for work for the Edison plant at Paterson, N. J.; the Hampton N. and A. Institute, Hampton, Va.; the Preston Fertilizer Company, Greenpoint, N. J., and the Standard Varnish Works, this city.

Bare Copper Wire.

The demand for bare copper wire was never greater at this season of the year among the various rolling mills, as the demand has up to the present time somewhat exceeded the output in certain centres, especially in the New York market, where it is getting down to a solid trade basis. Among the various rolling mills producing bare copper wire, etc., the name of Fuller Bros. & Co., 139 Greenwich street, this city, should become more familiar, as they have large facilities which they are continuing to increase, and are able to fill orders on command, or at short notice, for any quantity of bare wire, copper rod, conductor bars, and the various copper conductors which the market requires.

Sheet Hard Rubber

for the electrical trade is now being made in any thickness and breadth required, by the Consolidated India Rubber Company, of 25 Murray street. They are also making hard and soft rubber in tubes and rods in all sizes for electrical purposes, especially for arc and incandescent plants, etc.

The O'Keenan Battery.

The O'Keenan Company, of the Aldrich building, this city, reports an excellent demand for its battery, and has now some 50 large orders awaiting attention. The battery has been improved by Mr. Shedlock in various details. It is now being used for driving motors as well as running lights, and is greatly liked by all who have tried it.

The Sawyer-Man Company

has been increasing its facilities at West Twenty-third street by putting in a battery of two 250 h. p. Babcock & Wilcox boilers. The total increase will be 750 h. p. A Westinghouse compound engine of 150 h. p. is to be put in, and the lamp output will be 1,500 per day. The laboratory is now in full working order and is busy. Every lamp sent out is put through the photometer in this department.

The Engine Trade.

Messrs. Williams & Potter, of No. 2 West 14th street, the agents of the well-known Straight Line engine, report a brisk business for the past week. Among their orders I find 50 h. p. from the Martin Process and Chemical Company, and 50 h. p. from the Windsor Hotel, Philadelphia, the latter for running a plant of the Mayo system of electric lighting. The Edison Machine Works have ordered 80 h. p. for their new foundry; 35 h. p. goes to the University of Tennessee at Knoxville. An order from Buenos Ayres calls for 50 h. p., and another order for a 50 h. p. engine comes from Italy; 125 h. p. from Roanoke, Va., and another from Santa Barbara for 60 h. p.

The Ball Electric Light Company

has recently issued a neat little pamphlet regarding its system. As to the work done by Ball dynamos and lamps, some interesting figures are cited from the operations on the new aqueducts for this city, where the circuits are now running night and day the year around underground, and amid the most trying conditions.

New York Safety Engines.

Mr. E. T. Copeland continues to experience a very brisk demand for his horizontal and vertical engines. Note was made last week of several recent large orders, to which may be added a 100 h. p. horizontal with boiler for Albany, Ga., and two 100 h. p. horizontals for the Jersey Central Railroad, at Jersey City, both for Edison plants.

The New Fire Alarm for Cortland, N. Y.

I learn that the new fire alarm system installed for the little town of Cortland, N. Y., by the Union Fire Alarm Company, of this city, has been accepted and paid for by the village trustees. This installation of 25 signal boxes and necessary apparatus has 8 miles of wire, and was put up under guarantee, and accepted by the trustees by unanimous vote, and with the expression of much satisfaction at the working of the same.

A Large United States Plant.

The electrician in charge of the elegant electric light plant in the basement of the Equitable Life Insurance Company, at No. 120 Broadway, installed by the United States Company, takes great pride in showing his installation to visitors. It is certainly one of the best arranged and most ornamental installations that I have seen, the richness of the decorations being specially noteworthy. On entering the station, the first thing that attracts notice is the 150 feet of 9-inch shaft and the 6-foot pulleys. This shaft runs with such precision and is so accurately aligned that one would hardly perceive that it is revolving. It is a part of the big steam plant installed by E. P. Hampson & Company, under the supervision of Mr. Wilson, the engineer-in-chief of the building. Everything in the department of the latter is working in complete harmony. The firemen in charge of the boilers are under the control of an Edson recording and alarm gauge, which is set up in a handsome manner, mounted upon a fine marble base at the superintendent's station. In fact, all the side walls and floor of the installation are of marble. The steam-pressure pipe running to the gauge is gold-plated and kept at a high polish. I learn also from Mr. Wilson, the engineer, that the magnesia covering on the steam pipes is the best that has come under his notice as a non-conductor of heat. The switch-boards in the station are also novelties in themselves and will repay an inspection, the installation being open to the public.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Oct. 1, 1888.

Personals.

Mr. F. S. Terry, manager of the Western agency of the Electrical Supply Company, of Ausonia, Conn., was in this city last week.

Mr. F. E. Clark has resigned from the treasurership of the Campbell Electrical Supply Company, of this city.

The Thompson-Houston Electric Welding Company.

This company shipped recently to Messrs. John A. Roebling's Sons, Trenton, N. J., one of its machines for welding iron and steel wire. The machine is intended to weld wire ⅝ inch in diameter.

The Welding Company has plans perfected for erecting a large and commodious factory at Lynn, Mass., which will be exclusively occupied by the company. The new factory—when finished and equipped with modern and best-improved machinery—will afford ample manufacturing facilities to enable the company to promptly fill its numerous orders at very short notice. The new building will be 85 × 300 feet in dimensions, and the front part of one-half the factory being one story, and the rear half two stories in height. The manufacturing department and factory offices will occupy the entire first floor, the offices occupying a small space in the front part of the building. The second story of the rear end of the factory will be occupied by a drafting department, pattern-room, etc. Ground has already been broken, and work on the new building will be rapidly pushed forward.

Mr. Otis K. Stewart, the company's electrician, and Mr. John Tregoning, the superintendent, will give their personal attention to the arrangement of the different departments of the factory when complete.

Electric Lights for Wakefield and Peacedale, R. I.

The Narragansett Pier (R. I.) Electric Light and Power Company is extending its lines to Wakefield and Peacedale and expect to furnish a large number of electric lights in those towns.

Arc Lights for Webster, Mass.

The Webster Electric Company has been awarded a contract by the authorities of that town to furnish the streets with 35 arc lights. The Thomson-Houston system will be used.

Another Railroad Station Adopts Electric Lights.

The Boston & Albany Railroad Company has given an order to the Palmer (Mass.) Electric Company to furnish a sufficient number of arc and incandescent lights in the former's magnificent railroad station at the town named.

Electric Light and Power for Belfast, Me.

Mr. Thomas T. Robinson, of the Thomson-Houston Electric Company, has sold to the recently organized local electric light company at Belfast an electric light and power outfit, consisting of two 30-arc-light machines, one 500-light (alternating) incandescent dynamo, one power generator and several motors of various horse-power. The installation of this plant has already commenced, and it is expected that the electric light and power circuits will be ready to start up about the middle of October. The plant will be operated by water power, the electric light company having at its command a long lease on water privileges said to be capable of producing from two to three hundred horse-power every day in the year.

Boston Electric Club.

At a special meeting of the Executive Committee of the above-named club, held on the evening of Sept. 22, resolutions of regret were adopted on the death of Mr. Austin C. Wellington, of Cambridge, Mass., a late member of the club.

A Flourishing Enterprise.

The Hartford Steam Boiler Inspection and Insurance Company report a very satisfactory business for the first six months of 1888. The assets of the company July 1 amounted to $1,194,962.63, with liabilities for losses in process of adjustment of $9,450. The work of the company in its inspection department has done much to reduce the dangers incident to the use of steam. The insurance by the company covers loss or damage to property, and loss of life and injury to persons, caused by steam boiler explosions.

A Very Big Belt.

The Jewell Belting Company, of Hartford, Conn., has just completed a belt of such size that it deserves especial mention. It is 5 feet wide and 140 feet long, of two thicknesses of leather, and weighs over 1,600 pounds. It is the widest belt ever made by that concern, though not the longest or heaviest. It is for use in a rolling mill, where it has been found, after careful test, a leather belt is a safer and more economical means of carrying power than the direct action of cogs. In the latter case there can be no "give," while the belt is able to meet the sudden shocks upon it and vibrate a little, and yet fully transmit the power. In such wire mills as have used belts they have done their work well. One made by the Jewell Company, for a position where the desired width could not be utilized, was of four thicknesses of leather and heavier than this new and broader one. The new belt, with its fine work, has been on exhibition for a day or two as a choice specimen of belt-making.

Bell Instruments.

The instrument account for the month ended on the 20th ult. shows small changes, but there is a gain in telephones in use:

Month to Sept. 20.	1888.	1887.	Increase.
Gross output	3,920	4,110	*190
Returned	2,156	2,152	4
Net output	1,764	1,958	*194
Since Dec. 20.	1887-8.	1886-7.	
Gross output	41,660	40,651	1,009
Returned	16,802	19,815	*3,013
Net output	24,858	20,836	4,022

* Decrease.

Page Belting.

The Page Belting Company, of Concord, N. H., have a contract for belting the new Eufala Cotton Mills, at Eufala, Ala., thus adding another to the many large contracts they have received lately for new works in various parts of the country, and thus still further establishing their well-earned reputation for leather belting of the very best quality.

Work of the Sawyer-Man Company.

The Sawyer-Man Company are as busy as ever installing new plants and adding to old ones. Among the new installations they report the following: J. N. White, Jaffrey, N. H., 200 lights; Perry, Mason & Company, Boston, Mass., 150 lights; Saxon Worsted Company, Franklin, Mass., 100 lights; F. P. Jones & Company, Buffalo, New York, 75 lights; The Glasgow Company, South Hadley Falls, Mass., 400 lights; J. K. Earle Manufacturing Company, Worcester, Mass., 200 lights; Worth & Judd Manufacturing Company, New Britain, Conn., 150 lights; Wellesley College, Cambridge, Mass., 100 lights; Pratt Institute, Brooklyn, New York, 800 lights; G. H. Nichols & Company, Brooklyn, New York, 200 lights; Wild & Devereaux, Utica, New York, 200 lights; H. D. Klotz, New York City, 50 lights The Earnest Mill, East Mauch Chunk, Pa., 40 lights; Page Box Company, Cambridgeport, Mass., 250 lights; P. T. Noyes, Lancaster, N. H., 50 lights; H. J. Libby & Company, Madison, Me., 600 lights; American Baptist Publishing Society, Philadelphia, Pa., 200 lights; Ross & Baker, Port Oram, N. J., 250 lights; Reed & Lovatt, Weatherly, Pa., 200 lights. Among the late additions are the following: Griffin Manufacturing Company, Griffin, Ga.; Wild & Devereaux, Utica, New York; R. J. Oliphant, Oswego, New York; York Haven Paper Company York Haven, Pa.; Goodyear Metallic Rubber Shoe Company, Naugatuck, Conn.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Sept. 29, 1888.

Burlington, N. J.

The citizens of Burlington, N. J., have contracted with the Edison Company for lighting the city.

A Rapid Performance.

Mr. J. W. Parker, in superintending the installation of a new plant last week, did quite a remarkable thing at the stores of Herman Heller, 730 Arch street. He took charge of the old engine, which was to be replaced by a "Ball," at 8 P. M. Friday, tore down the old foundation, built a new one and had the whole thing in shape for the factory to start on Monday morning. Considerable work in the way of shafting and piping was necessary, and not a single hitch occurred in the transformation of the engine and boiler room. The work was done at the order of the United States Electric Lighting Company, and the engine will run, in addition to 100 incandescent and 10 arc lights, a freight elevator and 120 sewing machines.

The New Drexel Building.

This magnificent ten-story marble structure is now nearing completion, and is probably one of the finest structures in the United States. The combination gas and electric light fixtures are of an unusually handsome character, and were made by the Thackara Manufacturing Company, the electric light wiring being done by Messrs. Walker & Keppler, the well-known agents of the Edison Company. The fixtures were made according to de-

signs specially prepared to meet the requirements of the building. Each fixture is equipped with an equal quantity of gas and incandescent electric lights, and supplied with all the latest and most efficient devices used in manufacturing combination light fixtures. The fixtures for the main hall, first floor, are of wrought iron and those of the Board room of bronze, finished in French gilt, to harmonize with the white marble decorations throughout the room. Those in the offices and corridors are of brass and finished in antique. The building contains upward of 1,000 chandeliers, brackets, etc., representing a combined lighting capacity of 4,500 lights, representing, it is said, one of the most complete lighting plant that has ever been installed.

City Lighting Discussed.

At a meeting of Select Councils, last Thursday, Mr. Jones presented a resolution, which was adopted, providing for the appointment of a special joint committee to investigate the electric light question. The city, the resolution stated, pays to electric light companies $129,000 a year for 755 arc lights. This was claimed to be excessive, as the city, with a plant of its own costing $300,000, could supply light to 2,500 or 3,000 lamps at an annual expense of $90,000. The companies were also charged with furnishing only 1,200 candle power to many of the lamps, while their contract calls for 2,000 candle power. In view of these statements the committee was instructed "to investigate and report, with such recommendations for legislation as may be decided necessary to remedy the evils presented and further the best interests of the city." Messrs. Jones, Graham, Freeman, Thornton and Moffet were appointed as Select Councils' half of the committee. In speaking of the resolution Mr. Graham said that the Electrical Committee had considered the matter and had found that the plant would cost $400,000, and the annual expense would be more than $90,000. "Still we don't get the light we are paying for," he admitted.

New Telephone Building for Philadelphia.

The Bell Telephone Company has purchased the building Nos. 406 and 408 Market street, and will erect thereon a new structure, four stories high, which will be used as its exchange. The removal from Fourth and Chestnut streets is made necessary by the burial of the "trunk" lines of the company along Market street. The company will take possession of their new quarters about Jan. 1, 1889.

Electric Light Fixtures.

The centennial celebration at Pittsburgh calls to mind another fine piece of work by the Thackaras, it being the fitting up of the new court house with combination fixtures at a cost of over $20,000. This firm also made by special order the fixtures for the new and handsome buildings of the Manufacturers' and Rittenhouse clubs, the designs for which are works of art in themselves. The fitting up of club-houses by this firm seems to be a special feature, and their business is widely extending Some time ago, just after completing the fixtures in both wings of the capitol at Washington, they took a contract from the Metropolitan Club of Washington. The fixtures were made and placed in position, and within six hours after the job had been completed the building caught fire, and so much damage was done that almost all the work had to be done over again. The new fixtures will now be completed by Nov. 1.

Ball Engines for Lighting.

Mr. J. W. Parker, of the house of T. P. Conard, Third and Arch streets, has made the following contract for Ball engines: With the U. S. Electric Lighting Company for 35 h. p., used in connection with their system in the construction of an arc and incandescent plant in the store of H. Heller, at 730 Arch street; with John Wanamaker for 55 h. p., to be used in lighting his private estate at Chelten Hills. The system of lighting has not yet been decided on. J. B. Vansciver, of Camden, has also purchased a 35 h. p. Ball and 40 h. p. boiler, for use in connection with a Fort Wayne Jenney arc plant.

The Murray Flint Glass Works.

The new flint glass works, operated by James J. Murray & Co. under the name of the Murray Flint Glass Works, is now in full swing and crowded with orders for all kinds and styles of arc light globes and incandescent bulbs, which are being made for customers in all parts of the country. The factory is not only a credit to the city of Philadelphia, but to the electric light field, and is thoroughly adapted to the needs of the business. Orders have recently been filled for places in South America, and from all points the quality and finish of the goods turned out by this house have been spoken of in the highest terms. Mr. Murray's knowledge and experience in the business would alone be sufficient to command a large share of the electric light trade.

Water for the Edison Plant.

At a meeting of the Water Committee last Tuesday an application was received from the Edison Electric Light Company for a service of 40,000 gallons per day for their new station on Sansom street above Ninth. The application was granted with the proviso that the cost should be less than $2,000 for the first year. The Edison Company's new building, which will be one of the largest, most thoroughly equipped and handsomest central stations in the country, is nearing completion, and will probably be occupied within the next thirty days.

The Ball Engine.

The works of the Ball Engine Company, Erie, Pa., manufacturers of high-speed automatic cut-off engines are crowded to their utmost capacity with orders for their engines. Among their recent shipments are the following: Denver, Col., Electric Illuminating Company, two 80 h. p. engines; Seeger & Guernsey, St. Augustin, Mex., one 25 h. p. engine; city of Greenville, S. C., one 100 h. p. engine; Thomson-Houston International Electric Company, Australia, one 60 h. p. engine; Atlantic City, N. J., Electric Light Company, one 200 h. p. engine; Olean, N. Y., Electric Light Company, one 60 h. p. engine; Paterson, N. J., Electric Light Company, three 100 h. p. engines; Paterson, N. J., Electric Light Company, one 80 h. p. engine; Lynn, Mass., Gas Light Company, one 100 h. p. engine; Electric Improvement Company, Santa Clara, Cal., one 80 h. p. engine; Akron, O., Electric Street Railroad Company, two 200 h. p. engines; Electro-Automatic Transit Company, Baltimore, Md., one 100 h. p. engine; Pensacola, Fla., Electric Light Company, one 100 h. p. engine; Danville, Pa., Electric Light Company, one 80 h. p. engine; Brattleboro, Vt., Gas Light Company, one 80 h. p. engine; Walla Walla, W. T., Electric Light Company, one 35 h. p. engine; Thomson-Houston International Electric Company, Hiogo, Japan, one 25 h. p. engine; Ada, O., Electric Light Company, one 80 h. p. engine; Blaisdell & Pride, Jacksonville, Fla., one 40 h. p. engine; W. W. Cummer, Cadillac, Mich., one 100 h. p. engine; Paul Kubnke, Clyde, O., one 25 h. p. engine; City Gas Light Company, Norfolk, Va., one 80 h. p. engine.

Tatham Lead Cables.

Business at the Tatham Lead and Cable Works is reported to be rather better than usual for this season of the year. The Haverford Electric Light Company, which recently suffered a heavy loss by fire, had in use about seven miles of the Tatham cable, and with the exception of the very small portion which was directly exposed to the flames, none of it suffered any damage. This was one of the fortunate circumstances which enabled the Haverford Company to resume operations so soon after the fire. Mr. Engle, of the Tatham establishment, has some rather curious and remarkable relics of the disaster, which he values quite highly, since they illustrate so forcibly the action of fire upon a storage battery electric light station.

Underground Wires.

The much-talked-of but long-delayed movement for the burial of telegraph and telephone wires in this city has begun in earnest, and the Western Union and Bell Telephone companies propose to spend $250,000 to put all their wires underground between the two rivers and Vine and South streets. The work has already been begun, and the wires east of Fifteenth street will be underground before many months shall have passed. Those west of Fifteenth will go under the surface of the streets after the others shall have been buried. The contract for the building of the conduits has been awarded to Charles A. Porter. Already a conduit of brick has been laid on the south side of Market street from the Delaware River to Fourth street. It is 4 feet in width and 8 feet high. Within this conduit there have been placed 49 iron pipes, each 3 inches in diameter. Each pipe will hold 100 wires, so that the capacity of the conduit will be 4,900 wires. The conduit will extend out from Market to Thirteenth, up Thirteenth to Arch, from Arch to Fifteenth and down Fifteenth to Market, and thence to the Schuylkill River. The conduit on Market street will be known as the trunk line, and at every other cross street branch conduits will be laid to carry the wires north and south.

The plan that will be followed in making connections with buildings has been approved by City Councils and the Board of Highway Supervisors. The wires will be carried under ground to the centre of each block, where a tall pole, 75 or 100 feet in height, will be erected and from this point the wires will be run into the rear parts of the buildings. For instance, the block bounded by Second, Third, Chestnut and Market streets will be fed from a pole erected in Elbow lane. The block bounded by Second, Third, Chestnut and Dock streets will receive its wires from a pole erected in Carter's alley, midway between Second and Third streets. By this plan all the telegraph and telephone wires on the streets will be buried out of sight, and the objectionable poles removed as well.

The location of the trunk line on Market street will compel the removal of the Bell Telephone Company's exchange from Fourth and Chestnut streets to a place on Market street not far from its present location. Mr. W. B. Gill, general superintendent of the Western Union Telegraph Company for this district, said that the change would be a great improvement, and that it would be pushed to completion as rapidly as circumstances will permit. He said the business centre of the city will, in a comparatively short time, be completely free from overhead wires.

Underground Cables in Washington.

Among the appropriations agreed to in the General Deficiency appropriation bill in the Senate last week was one appropriating $15,138 to pay the Standard Underground Cable Company, of Pittsburgh, for underground electric cables, connecting the Capitol and the Departments in Washington. E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Sept. 29, 1888.

The Proposed Telephone Ordinance.

Aldermen Ernest and Tiedmann, representing the Committee on Licenses of the Council, called on Corporation Counsel Green to advise him to make the ordinance for the Chicago Telephone Company the same as that granted the Cushman Company, which they accepted. That ordinance provides for a charge of either $90 for the first year, $85 for the second, and $75 for the third, if taken for three years, or $75 a year if taken for one year, with a chance of a raise any time after the year had expired. Mr. Phillips, the telephone company's manager, said at the last meeting of the committee that they could not do business at the $75 rate except at a loss, but the Aldermen, so the *Tribune* says, think that a company which paid $600,000 dividends on a million of capital can well afford to experiment a little at the $75 rate. If the company does not choose to accept such an ordinance the Aldermen are prepared to gently coerce them by ordering the Commissioner of Public Works to cut the wires, or by commencing quo warranto proceedings to ascertain why they are doing business without a license.

The Pullman Electric Railway.

Ground was broken on Tuesday last for the new electric street car line at Pullman. The track is being laid rapidly, and it is hoped to have it in operation by Nov. 1. The rails used are similar to those now in use on other electric railways. The original length of the road will be four miles, which will be increased during the coming year. In an interview with Mr. Charles L. Pullman, who has in charge the street car department of the Pullman Works, this week, I learn that the system to be used has not been decided upon as yet, but that it will in all probability be a combination of various systems, as the object of the road is for experimental purposes as well as for affording transportation to the people who live along the route. A portion of the road is to be equipped for using the overhead system, while another portion will probably be furnished with an underground conduit which, however, will not be laid at present but can be, later, without interfering with the track. In this way the promoters of the different systems will be given a chance to show the efficiency of their system. The Pullman Company have the greatest faith in the future of electric street railways and are accordingly increasing their facilities for manufacturing motor cars which they will make a specialty. The building of their road is an evidence of this faith, and by means of it they will be enabled to build a motor car of any special design, equip it with a motor and test it before it is sent to the purchaser. While they are inclined to believe that no electric railway system at the present time is absolutely perfect, but is capable of further improvement, they hope to be able to help in the development.

A New Corporation.

The Secretary of State this week issued a corporation license to the Combination Electric Chain Company, of Chicago; capital, $100,000; incorporators, Nels Sorenson, Julius Ebert and Henry C. Hunsberger.

An Exhaust for the Edison Station.

W. C. Lyman is fixing up and refitting in a substantial manner his shops and offices. This will give him much needed space and afford him better facilities for manufacturing. Mr. Lyman has just completed for the new Chicago Edison central station a 26-inch main exhaust and a 16-inch exhaust head, which is to be placed on a tributary to the main exhaust. He has also put in the same station the necessary safety valve escape pipe, from 9 to 11 inches in size. Mr. Lyman is doing a large business in furnishing street paving supplies, such as pouring kettles, etc., for the different electric companies. The city electric light plant, corner of Clinton and Washington streets, was recently furnished by him with a No. 7 exhaust head. He is also supplying the new steam bridges with exhaust heads. These, I may add, are lighted by electricity.

Doings in the City Council.

At the meeting of the City Council last Monday night a supplemental petition was presented from the West Chicago Rapid Transit Company, asking that the initial point of the proposed line be fixed at the intersection of Ogden avenue and Randolph streets. In the original petition no eastern initial point was definitely fixed.

Alderman Ernst, from the Committee on Licenses, presented his telephone ordinance fixing rentals at $90, $85 and $75 for the first, second and third years respectively. A minority report, signed by Aldermen Bartels, Burke and Monear, was presented, leaving the rental question untouched, but fixing a 2½ per cent. tax on gross receipts, payable to the city half-yearly, in July and January, the gross receipts to be sworn to by the secretary and president of the telephone company. The ordinance recommended by the committee, except so far as the tax provision is concerned, is similar to that already introduced, and has been drafted by the attorneys of the telephone company. The consideration of the ordinances was made the special order for Monday week.

Clean Boilers.

I recently saw the Purves self-operating boiler cleaner, a device for keeping steam boilers free from mud and scale. It is especially recommended for boilers where high speed engines are used, for removing the oil. I learn also that the apparatus is in use in the station of the Merchants' Electric Light and Power Company of Danville, Ill.

Some Large Heaters for Central Stations.

I saw this week at the extensive works of Wm. Baragwanath & Son two very large feed-water heaters and purifiers which had just been completed, and were awaiting shipment for the Edison Electric Illuminating Company, of New York. Each one of them is built for 1,000 h. p., being 4 feet in diameter and 22 feet long, with a 26-inch exhaust. They are made of a special design, the steam passing directly upwards through the tubes and jacket together. Messrs. Baragwanath & Son are an old and well-known firm, having been engaged in the manufacture of their specialty known as their steam jacket feed-water boiler and purifier for the past eleven years, and have at present about 4,000 of them in use, 500 of the number being in Chicago alone. A large number of these are now in use in electric light stations, being especially adapted for that service. The company are now getting out a new superheater for purifying water by means of live steam, a device which will be used where very bad water is to be found. The manufacturers guarantee their heater to deliver water at a temperature of 212 degrees, or, in other words, to boil the water.

Progress of the Baxter Motor.

Mr. W. W. Monroe, Western manager of the Baxter Company informs me that he has at present 37 motors in Chicago alone, aggregating 49 h. p., and running in different trades, including bookbinders, coffee mills, clothing and cloak manufacturers, electrical apparatus manufacturers, hat and cap manufacturers, leather, jewelry, etc.

Personal.

Mr. F. S. Terry, manager of the Electrical Supply Company, of this city, is making a trip to the East in the interests of his Western customers.

Mr. Wm. Baragwanath, the well-known manufacturer of feed-water heaters and purifiers, died on Thursday, Sept. 20.

Activity in Electrical Matters.

The wonderful activity in electrical matters is evidenced by the demand for electrical goods. The wire men seem to be unusually busy. The Electrical Supply Company have just been compelled to increase their working force in order to run their factory both night and day, the demand for wire in general, and the P. & B. brand in particular, being so brisk.

Bloomington, Ill.

The recent strife in this city with reference to lighting the streets by electricity has come to an end by the purchase of 240 arc lights of the Ft. Wayne Jenney system. It was decided some time ago to purchase such a plant, and the order was placed for same for which the city was to pay cash, and the trouble arose from the fact that the city's warrants were adjudged illegal, as it made the amount beyond the limit of loan. All, however, has been adjusted satisfactorily.

The Chicago Electric Club.

President Barton was unable to be present at the meeting of the Board of Managers of the Chicago Electric Club last Thursday evening. The meeting was called for the purpose of listening

to reports of committees and to take some action with reference to new quarters. A desire prevails among a large number of the members of the club to get into new and more pleasant quarters. The present "café" service has not been found satisfactory by many. No action was taken at the meeting aside from the reappointing of the old committees and deciding to call another meeting.

Galena, Ill.

The city has just purchased 500 incandescent lights of the Slattery induction system for lighting its streets. A new feature of the system will be used, consisting of the placing of a separate converter for each street lamp. A 16 candle-power lamp will be placed in every block. The distance covered by the lights will be 7 miles, 14 miles of wire being required for the circuits.

An "Electrical" Wagon.

I was shown one day this week by Mr. W. Hubbard of the Elgin Telephone Company, a novel advertising wagon which he had on our streets. It was fitted up with electric bells, burglar proof matting, etc. The cover of the wagon was well decorated with announcements regarding electrical specialties and the Elgin Telephone. It will be used in traveling through country towns with electric supplies. Mr. Hubbard thinks he will be able to run it by electric power, eventually.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$150@$155	Iowa Union	$28@ $29
Central Union	47@ 48	Michigan	81@ 82
Chicago	340@ 345	Missouri and Kansas	70@ 71
Colorado	43@ 46	Rocky Mountain Bell	41@ 43
Cumberland	65@ 68	Wisconsin	110@ 112
Great Southern	34@ 37		E. L. P.

THE TELEGRAPH.

Victory for Western Union.—Judge Tuck, in a judgment delivered Sept. 20, refused to dissolve the injunction obtained by the Western Union Telegraph Company on Aug. 1, restraining the Canadian Pacific Railroad & Telegraph Company from building a telegraph line on the right of way of the New Brunswick Railway, between Vanceborough and St. John.

THE TELEPHONE.

Bell Telephone Dividend.—The Bell Telephone Company has declared a regular quarterly dividend of 3 per cent., payable Oct. 15 to stock of Sept. 29. The books will be closed from Oct. 1 to 13.

THE ELECTRIC LIGHT.

Troy, Ala.—The Troy Fertilizer Company is to put in a plant.

Saccarappa, Me.—The Haskell Silk Company, at Saccarappa, contemplate putting 250 electric lights into their new mill.

Statesville, N. C., will decide by a popular vote on Oct. 8 whether or not to issue $8,000 of bonds to erect an electric light plant.

Washington, D. C.—The United States Electric Lighting Company will add machinery to their plant for incandescent lighting.

Columbia, Tenn.—It is said that an electric plant will soon be erected by the Columbia Electric Light and Power Co., of Columbia, Tenn.

Galena, Ill.—The Galena Electric Light Company has been organized with a capital of $10,000. John A. Mensel and others are the incorporators.

Clinton, Ill.—Vespasian Warner and others have incorporated the Clinton Electric Light, Heat and Power Company, with a capital of $25,000.

Chicago, Ill.—The Merchants' Arc Light and Power Company, of Chicago, has been organized, with a capital of $30,000, by W. H. Collins and others.

Glenwood Springs, Col.—The Glenwood Light and Water Company has been organized, with a capital of $250,000, by Walter Devereux and others.

In Building Operations.—At Woonsocket, R. I., work is being continued night and day on the new opera house. Electric lights are used for night work.

Menominee, Mich.—The Menominee Electric Light Company, which recently purchased a Brush incandescent outfit, has now made additions to its Brush arc plant.

Saginaw, Wis.—The Saginaw Manufacturing Company are putting in an isolated plant of 250 incandescent lights of the Thomson-Houston system for lighting their mill.

Lexington, Va.—Childs & Macmurdo, of Richmond, have asked for a permit to erect an electric light plant. If granted they will erect a plant to cost not less than $10,000.

The Consumers' Electric Light Company, of Chicago, have just placed an order with the Heine Safety Boiler Company for three 250 horse-power Heine boilers; total, 750 h. p.

The Electrical Accumulator and Lighting Company, of East St. Louis, capital stock, $250,000, has been incorporated by William L. Hill, Charles Sutter and William S. Rogers.

Washington, D. C.—The Georgetown & Tenallytown Railroad Company, about to build an electrical street railroad, have organized with Gen. Drum as president and John Beall treasurer.

Philadelphia.—E. W. Tisdall, Philadelphia agent for the Brush Electric Company, has recently sold to parties in Philadelphia one 65-light 2,000 c. p. arc dynamo with a full complement of lamps.

Brockport, N. Y.—B. W. Payne & Son, Elmira, N. Y., are building a new 80 h. p. compound horizontal engine for the Thomson-Houston Electric Light Company's new station at Brockport, N. Y.

Athol, Mass.—The Athol Electric Lighting and Power Company is about to put in the incandescent plant called for by the contract with the town. The delay has been caused by difficulty in getting poles.

The Minneapolis Exposition.—The Brush Electric Company has recently sold an incandescent electric light plant, consisting of 1,000 incandescent lights, to the Minneapolis (Minn.) Exposition.

Fort Madison, Ia.—S. & J. C. Atlee, of Fort Madison, Ia., have recently increased their electric light plant by purchasing from the Brush Electric Company, of Cleveland, O., a number of arc lamps.

Electric Light Apparatus Wanted.—W. E. Sinclair, of Ashland, Va., desires to purchase a dynamo and lamps, and the Standard Scale Works, Rome, Ga., are looking about for a 50-light incandescent machine.

Slaterville, R. I.—The Forestdale Manufacturing Company will light its mills in the future by 300 incandescent lights, Sawyer-Man system. A 45 h. p. Westinghouse engine will furnish the power to run the dynamo.

Seattle, W. T.—The Northwestern Electric Supply and Construction Company, of Seattle, W. T., has contracted with the Northern Pacific to light Stampede Tunnel. Three hundred 30 candle-power lights will be used.

Schuyler Electric Lights.—The Schuyler Electric Company report contracts at Chambersburg, Pa.; St. Helena, Cal.; Marion, O., and 200 arc light addition to the Virginia Electric Light & Power Company at Richmond, Va.

Mystic, R. I.—The contract has been closed for the introduction of the Waterhouse system of electric lights into Mystic, R. I. Four hundred lights have already been engaged, and the number will be much increased without doubt.

Wauwatosa, Wis.—The work of erecting the electric light plant at Wauwatosa, a suburb of Milwaukee, has just begun. The plant will include arc and incandescent systems, the arcs to be used for the streets and the incandescents in lighting residences.

Easthampton, Mass.—The People's Electric Light Company, of Easthampton, have ordered their electric plant of the Waterhouse Electric and Manufacturing Company, of Hartford, Conn. They will use a combined plant of arc and incandescent lights.

Helena, Mont.—The Hill Clutch Works, of Cleveland, O., are now shipping two car-loads of clutches and power transmission machinery for an electric light plant at Helena, and will shortly make a smaller shipment for Sacramento for the Capital Gas Company.

Lawrence, Mass.—The Atlantic Cotton Mills, of Lawrence, Mass., who purchased last season 45 arc lights of the Waterhouse Electric and Manufacturing Company, of Hartford, Conn., have just ordered 77 additional. They are pleased with the Waterhouse system.

Increase of Plant.—The Brush Electric Company have recently sold to Woods, Jenks & Co., of Cleveland, O., a 30-light 2,000 c. p. dynamo, with a full complement of lamps. The same firm recently installed a large Brush incandescent electric light plant consisting of four hundred lights.

Brush Lights.—The Brush Electric Company have recently sold to parties in Princeton, N. J., a 225-light incandescent plant, complete. They have also sold to the Brown Hoisting and Conveying Machine Company, of Cleveland, O., a large arc and incandescent electric light plant for use in their shops.

San Antonio, Tex.—The San Antonio Gas Company have just added to their electric light plant by purchasing another 30-light, 2,000 c. p. arc dynamo from the Brush Electric Company, of Cleveland, O. This plant is a new one installed within the last year. They are now operating 150 Brush arc lights.

River Steamers.—The Brush Electric Company, Chicago, Ill., and its Western agents, have sold during the past season a large number of electric light plants for steamboats on the Mississippi and its tributaries. Some of the Brush plants on the Mississippi River steamboats have been in use for a number of years.

Mt. Vernon, O.—The Schuyler Electric Light Company of Mt. Vernon will start up with 130 arc lights Oct. 1. This plant has been furnished and equipped by the Schuyler Electric Company, of Middletown, Conn. The plant recently installed at Millersburg, O., by this company, will immediately double its capacity.

Bristol, Pa.—The New Electric Light and Power Company, of Bristol, Pa., has chosen these officers: President, Philip Halzell secretary, S. Weir Gilkeson; treasurer, Charles E. Scott; directors, Philip Halzell, W. H. H. White and Joseph Grundy. The capital is to be $30,000, and it is expected to have the works in operation by Dec. 15.

Bloomington, Ill.—The designs submitted to the City of Bloomington for their electric light station by the Hill Clutch Works, of Cleveland, O., were accepted, and the contract for the entire power transmission machinery outfit awarded them. The building will also be built according to their designs and under the supervision of their engineers.

Duluth, Minn.—Alex. Kempt, at the head of the Chicago branch of the Brush Electric Company, has just sold an electric light plant to the Lehigh Coal Company, of Duluth, Minn., consisting of two 2,000 c. p. Brush dynamos, with full complement of lamps. In addition to this, to be operated in connection with the plant, are one 18 h. p. motor and one 11 h. p. motor.

The Kingston and Roundout Schuyler Electric Light Company, of Kingston, N. Y., who recently enlarged their plant, report their apparatus all in use, with a demand for more. They are considering a further addition, so as to be able to supply the increasing demand for their light. The addition of an incandescent plant in connection with the arc is also contemplated.

The Hill Clutch Works, of Cleveland, O., are furnishing the Brush Electric Company, of that city, for their works, a number of their friction clutch pulleys and couplings, together with other power transmission machinery. They are also furnishing a number of their friction clutch pulleys and other power transmission machinery for the John York electric plant on South Halstead street, Chicago.

Electric Perforated Belting.—Chas. A. Schieren & Co., report recent sales of their new electric perforated belting for use on dynamos to the following electric light companies: Allegheny County Light Company, Pittsburgh, Pa.; Scranton Illuminating Heat and Power Company, Scranton, Pa.; Framingham Electric Company, South Framingham, Mass.; Electric Light, Heat and Power Company, Carbondale, Pa.; Jenney Electric Light and Power Company, Indianapolis, Ind.

Pole Chopping in New York.—The gang of men employed by the city, under the direction of Inspector Roth, have removed all of the Manhattan Company's poles from Thirty-second to Fiftieth streets in Second avenue, and have now began work below Thirty-second street and will soon reach Twenty-third street. The poles are from 65 to 85 feet high, but so far no accident has resulted from taking them down. They are sent to the corporation yard, and can probably be sold for nearly enough to pay for their removal.

Allegheny, Pa.—The committee which was appointed some time ago by the Allegheny councils to decide as to whether an electric lighting plant should be purchased for the use of the city, or rented, as has been done heretofore, has decided to purchase a plant. The systems decided upon are those of the Indianapolis Jenny Company and the Edison. The former will furnish the arc system, and will be used entirely for street lighting, while the Edison system will be used for interior lighting. The entire cost will amount, when completed, to $108,000.

The Westinghouse Engine.—Westinghouse, Church, Kerr & Co. have issued a summarized list of parties who have purchased three or more Westinghouse engines. The Buffalo Brush Company has 24 of 1,995 h. p.; the Allegheny County Company, 19 of 1,635 h. p. The Southern Cotton Oil Company has bought 69 of a total 3,700 h. p. Of such large purchasers there are nearly 100, and there are 400 customers who have bought two engines, and 1,500 who use one engine. The sales for the month of August are 12 compound, 27 standard, and 31 junior Westinghouse engines of a total of 3,770 h. p. Several of these went to electric light companies.

APPLICATIONS OF POWER.

West Haven, Conn.—The plan of using electricity as a motive power on the West Haven Street Railway is being actively discussed.

Dallas, Tex.—It is rumored that the Dallas Street Railroad Company will run their cars by electricity, power to be furnished by the Dallas Electric Light and Power Company.

Asheville, N. C.—The Asheville Street Railroad Company have ordered machinery for the power plant of their new electric railway. W. F. Penniman is president of the company.

Power for Coke Ovens.—The Grand River Coal and Coke Company is putting in an electric plant at Glenwood, Colo., to work with water under a head of 470 feet, and proposes to transmit power to its coke ovens three miles distant. The company has now fifty ovens, and is building fifty more.

PERSONALS.

Mr. A. A. Knudson, after a short sojourn in this city, has returned to St. John, N. B., making his headquarters at the Clifton House.

Sir John Pender, K. C. M. G.—Sir John Pender had a private audience of the Sultan recently, and received from His Majesty the Grand Cordon of the Medjidieh.

MISCELLANEOUS NOTES.

A Correction.—In our notice of the new edition of Thompson's "Dynamo Electro Machinery" the price was given as $6. This should have been $5.

Chicago, Ill.—The Nutting Electric Manufacturing Company has been organized with a capital of $100,000 for the purpose of manufacturing electrical apparatus.

Change of Name.—The Tucker Manufacturing Company, Newark, N. J., has filed a certificate with the county clerk, setting forth that its corporate name has been changed to the Tucker Electrical Construction Company.

The Electric Date and Time-Stamp Company, at East St. Louis, capital stock $1,000,000, has been incorporated by William H. Stevenson, Henry H. Werse, James B. Johnson, J. M. Thompson and Hamilton Daughaday.

A Correction.—Mr. S. S. Leonard desires us to state that a slight error crept into his paper on "Petroleum Fuel," read before the National Electric Light Association. Instead of "111.34 h. p. running six hours," read "111.34 h. p. running *seven* hours."

"Subway Jobbery" is the heading given by the *New York Herald* to a page article in its issue of Sept. 23, dealing with the Board of Electrical Control, the Consolidated Telegraph and Electrical Subway Company, the Phœnix Construction Company and the subways themselves. It is racy reading, but cannot be said to develop any new facts.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos Send for their price list and catalogue, or write to them, stating what you want.

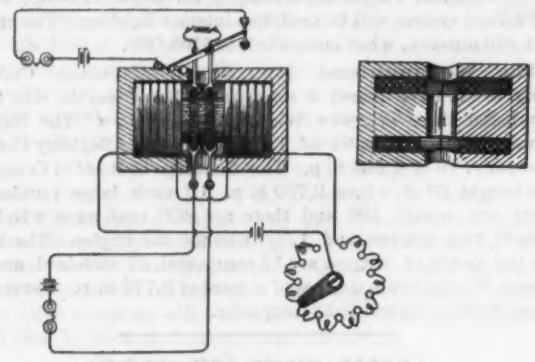
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED SEPTEMBER 18, 1888.

389,601. Mechanical Telephone System; Abner M. Rosebrugh, Toronto, Canada. Application filed Oct. 21, 1885. Patented in England, Aug. 22, 1885, No. 9,962. A series of conductors extending from subscribers' stations to a central office; a series of tubes arranged in juxtaposition in the central office, and a flexible coupling tube having terminal rigid ferrules adapted to fit over the ends of the aforesaid tubes.

389,638. Electrical Distribution by Secondary Batteries; T. P. Conant, New York, N. Y., Assignor to the Electrical Accumulator Company, of New York. Application filed April 10, 1888. A primary generator of electricity located at one station, two or more sub-stations, at each of which are located one or more series of secondary battery cells, a charging circuit containing the primary generator and electrically uniting all stations, a working station containing a series of translating devices, and electrically uniting all sub-stations, and a switch or circuit changer for each series of battery cells, whereby each and every series of cells may be included in either circuit.

389,640. Rheotome Mechanism for Medical Batteries; H. B. Cox, Cincinnati, Ohio, Assignor to the H. B. Cox Electric Company, of New Haven, Conn. Application filed Dec. 17, 1887. A suitable lid or cover for the case, and contacts secured to and moving with the cover, said contacts being electrically connected with each other at their main portions,



389,883. TELEGRAPHY.

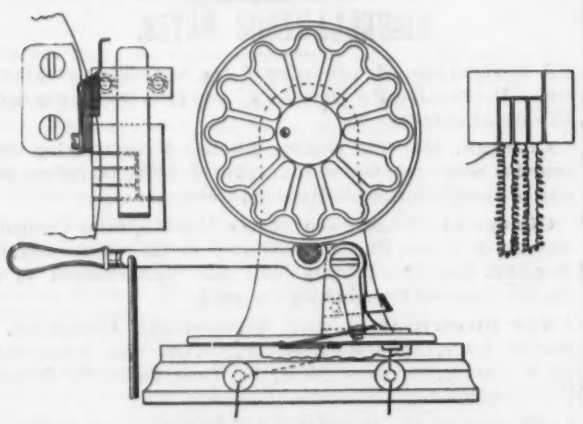
whereby when the cover is thrown open, the contacts carried by the same electrically engage the contacts on the case, and when the cover is closed the contacts are thrown out of engagement.

389,658. Armature Winding for Dynamo Electric Machines: Walter H. Knight, New York. Application filed June 6, 1888. The invention consists in making up the winding into a mat, which may be made by machinery, and the applying the same to the ordinary cylindrical core of magnetic material. This mat may be easily wrapped around the core, the binding straps put around it, and the connection made with the commutator. See illustration.

389,676. Cell for Electric Batteries; Sylvanus L. Trippe, St. Louis, Mo. Application filed June 10, 1887. The cell is provided with a flanged or ribbed bottom for strengthening purposes and also incloses a frame for supporting the electrodes.

389,678. Fire Alarm System; T. G. Turner, New York, N. Y. Application filed Feb. 6, 1888. A chemical fire extinguisher is suspended by means of an arm thereon from a signal-box or other suitable device placed in an electric circuit, so that when the extinguisher is removed from the signal-box or device the signaling device is operated and the alarm of fire is sent to the public station of the fire department or to the office where the sounding device is located.

389,692. System of Electrical Gas Lighting and Extinguishing; Harry T. Downs, Saratoga Springs, N. Y. Application filed Dec. 20, 1887. An electric gas lighting and extinguishing system comprising a station battery and two lines



389,876. ELECTRIC MOTOR.

having a common return, both said lines being normally open at the station, and two or more electric gas lighting and extinguishing burners arranged and adapted to be placed in either of said circuits at will.

389,729. Electrical Heating Apparatus; John Wiest, York, Pa. Application filed June 15, 1888. The invention embodies a metallic heat radiator separated from the resisting material by a heat-conducting and electric insulating substance, such as a silicate of an alkali or compound containing the same.

389,752. Conductor for Dynamo Electric Machines; E. F. H. H. Lauckert, Charlton, County of Kent, England, Assignor to Siemens and Halske, Berlin, Germany. Application filed Jan. 14, 1888. Patented in England, Aug. 23, 1887, No. 11,502. A conductor consisting of a twisted strand of wire compressed so as to assume an oblong or approximately rectangular transverse section. See illustration.

389,758. Ground Detector for Electric Light Circuits; A. W. Morrell, Indianapolis, Ind., Assignor to the Jenney Electric Company, same place. Application filed June 11, 1888. A switch is interposed in the ground connection.

389,764. Electric Therapeutic Cap; N. P. Rutter, Waltham, Mass. Application filed May 2, 1888. An electric cap having in its crown an electric battery provided with suitable terminals.

389,779. Direct Welding Dynamo Electric Machine; Elihu Thomson, Lynn, Mass. Application filed May 29, 1888. A dynamo generator having current collecting brushes attached to the conducting clamps or electrodes which hold the work.

(1) 389,795. (2) 389,838. Means for Distributing Electric Energy; S. Z. De Ferranti, London, England. Applications filed April 17 and 18, 1887, respectively. (1) A converter in the form of a Gramme ring, consisting of a core made up of a bundle of strips or ribbons of iron insulated from each other, but each forming a closed magnetic circuit, superposed primary and secondary windings and exterior rings or layers of soft iron. (2) An electrical converter, of

389,752.—CONDUCTOR FOR DYNAMO-ELECTRIC MACHINES.

primary and secondary coils, strips, layers, or laminæ of iron arranged in part within the coils and formed into a series of closed magnetic circuits extending through and outside the coils by overlapping such strips or layers, and insulating material separating the layers of iron forming the magnetic circuits.

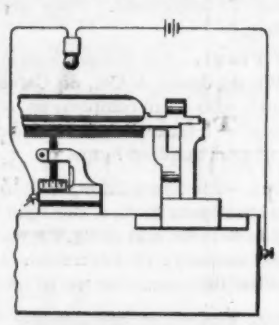
389,796. Dental Engine; Constant Doriot, Philadelphia, Pa. Application filed Feb. 18, 1887. The upright frame or standard of a dental engine has a laterally projecting skeleton frame cast integral therewith, and an electromotor attached to and supported within the said frame.

389,799. Automatic Circuit Maker and Breaker; W. W. Estabrook, Boston, Mass.; application filed May 23, 1888. An automatic circuit maker and breaker having one or more stationary members, and having a moving member mounted on a revolving plate and sliding stop bolts which engage with projections on said plate, and a disk on the hand arbor of a clock, the stop bolts being controlled by said disk.

389,812. Dynamo Electric Machine; Thomas Hicks, Detroit, Mich. Application filed May 26, 1887. The invention consists in arranging the circuits in the machine, so that the windings may be readily coupled in multiple arc or series, as desired, and in providing a set of brushes, one set being adjustable by hand, so that the current developed may be still further varied by cutting out coils of the armature or field magnet.

389,822. Electric Railway System; John D. Nicholson and William J. McElroy, of Pittsburgh, Pa., and Thomas J. McTighe, of New York, N. Y. Application filed Dec. 24, 1887. An insulated underground main conductor, a series of boxes containing each a pivoted magnet connected with said main conductor, and having a magnetizable metal plug or cap in inductive relation to said magnet, but normally disconnected therefrom, a motor car having a contact bar capable of spanning and touching two such metallic plugs at once, and an electro-magnet on said car having one pole in inductive reach of said plug. See illustration.

389,839. Telegraphic Call for Messengers, Etc.; B. Dubinski, of St. Louis, Mo., Assignor to Charles P. Budd,



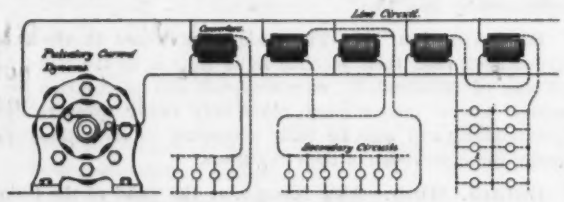
390,101. TESTING DEVICE FOR CARD FLATS.

Lambert J. Kiser and Wm. J. Kiser, of same place. Application filed Nov. 14, 1887. This is an electro magnetic device by which, by the mere turning of a crank, a certain number is indicated by a relay magnet at a distance, say from a private office to a messenger office, and by turning a crank at the messenger office acknowledgment of the reception of the call is made to the private office, and a bell sounded indicating that such acknowledgment has been sent.

389,853. Safety Apparatus for Elevators; Charles E. Ongley, New York, N. Y. Application filed Nov. 21, 1887. The invention consists, primarily, in a circuit-breaking device controlled by the door, so that the electric circuit through which the movements of the elevator are controlled is only maintained closed when the door is closed.

PATENTS DATED SEPT. 25, 1888.

389,870. Registering Meter for Electric Currents; James D. Bishop, San Francisco, Cal. Application filed Dec. 24, 1887. It consists of indicating dials with suitable gearing by which they are actuated, an adjustable pawl and ratchet mechanism, by which the movements of the indicating dials are regulated, and an oscillating arm or pendulum actuated by the passing current, together with a mechanism by which the



389,974. SYSTEM OF ELECTRIC DISTRIBUTION.

movement of the ratchet wheel is increased or diminished in proportion to the current which is passing.

389,876. Electric Motor; P. Diehl, Elizabeth, N. J. Application filed Feb. 7, 1888. The mechanism for braking the fly-wheel is connected to a lever which operates the motor regulator. When the regulating lever has moved sufficiently to stop the motor, the brake is automatically applied. See illustration.

389,882. Secondary Battery; Camille A. Faure, New York, N. Y., Assignor to the Electrical Accumulator Company of New York. Application filed Feb. 2, 1888. An element of zinc, containing finely divided compressed zinc, and an element of copper, both located in an electrolytic solution containing phosphate of potash.

389,883. Telegraphy; S. D. Field, Yonkers, N. Y. Application filed May 8, 1888. The invention comprises, in connection with other devices, a special character of compound relay constructed for use in connection with the multiple system. See illustration.

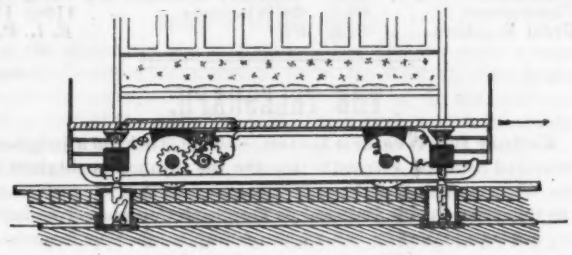
389,888. Electric Incandescent Lamp and Attachments; I. W. Heysinger, Philadelpia, Pa. Application filed March 31, 1887. Details relating to the method of connecting the globe to the socket, the manner of sealing in the wires, the lamp switch, and an improved swivel connection.

389,894. Dynamo Armature; William G. Meyers, Philadelphia, Pa., and Frederick E. Coward, Camden, N. J. Application filed May 5, 1887. In an armature of a dynamo electric machine, semi-circular segments mounted on guide bars to form rings, the opposing ends of the segments being insulated from each other by air spaces or any insulating material.

389,935. Electric Storage System; W. H. McDonald, Albany, N. Y. Application filed May 7, 1888. An electric storage system composed of two or more lamp circuits, each of which is supplied with a storage battery, and each of which lamp circuits is connected with the other lamp circuit or circuits by an intermediate circuit provided with a means for breaking the current on the intermediate circuit between the storage batteries.

389,913. Electrical Conductor and Insulating Conduit; R. F. Silliman, Troy, N. Y. Application filed Dec. 9, 1887. A single line electrical conductor and insulating conduit composed of sections, each section consisting of an electrical conductor, screw threaded at one end and correspondingly screw tapped at the other end, embedded in an insulating material, enclosed in a tube shorter than the conductor.

389,974. System for the Distribution of Electric Energy; Gustav Pfannkuche, of Exeter, N. H., and Alfred Pfannkuche, of Cleveland, Ohio. Application filed May 11,



389,822.—ELECTRIC RAILWAY SYSTEM.

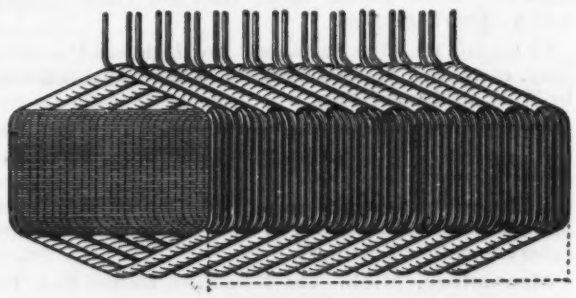
1887. Claim 1 is as follows: The art or method of electrical distribution, which consists in charging a line circuit with a continuous current of uniform direction, and of rapidly rising and falling potential, and thereby generating in one or more secondary circuits, located within inductive proximity of the line circuit alternating currents of lower potential, and utilizing said alternating currents to feed electric translating devices. See illustration.

390,058. Telephonic, Telegraphic and Signaling Circuit; E. I. Bernheim, Paris, France. Application filed March 16, 1888. To permit any two stations to call one another directly, and to place themselves in communication without the necessity of giving notice to a central station, and without calling either intermediate stations or the terminal stations of the line.

390,062. Angle Hanger for Mechanical Telephone Lines; R. C. M. Bowles, Boston, Mass. Application filed Nov. 15, 1887. A curving bar made of elastic tempered metal adapted at each end for connection with the line sections.

390,067. Galvanometer; I. W. Chisholm, New Concord, Ohio. Application filed May 21, 1886. A specially constructed galvanometer in combination with two detachable electrode arms, respectively carrying plates of metal of different electrical inherent properties, preferably zinc and copper, to be placed within the mouth and acted upon by the acids and alkalies of the human saliva, thereby causing a molecular excitation of said plates and a generation of an electric current, the tension of which will be registered and indicated by the needle of the galvanometer moving relatively in connection with a predetermined scale.

390,101. Electric Testing Device for Card Flats; Edmund Tweedale, Accrington, England, Assignor to John Bullough of same place. Application filed May 28, 1888. Patented in England Jan. 22, 1886. No. 984. The invention relates to apparatus or means for testing the correctness or ac-



389,658.—ARMATURE FOR DYNAMOS.

curacy of the card flats employed in carding engines. See illustration.

390,113. Electric Testing Device for Carding Machines; John Bullough, Accrington, England. Application filed May 16, 1888. Patented in England Feb. 9, 1886. No. 1,849. It consists in electrically connecting the card flats and card cylinders and suitably insulating the framing of the machines, so that the circuit may be completed only by the contact of the teeth on the card flats with the teeth on the cylinder.

390,115. Electric Current Indicator; P. B. Delany, New York, N. Y. Application filed May 26, 1888. An electric current indicator for the use of persons exposed to danger from high tension currents, consisting of a ring or band adapted to be worn upon the hand having an electric current indicator thereon. See page 188, this issue.

390,180. Dynamo-Electric Machines; Wm. Mather and Edward Hopkinson, Manchester, County of Lancaster, and John Hopkinson, of Westminster, England. Application Sept. 19, 1887. Patented in England Nov. 27, 1884. No. 15,648. The field magnets comprise solid wrought-iron cores and cast-iron poles of much greater sectional area than the cores, the latter being let into the former and being at their bends entirely surrounded by the metal forming the poles.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.